

UNCLASSIFIED

CHAPTER VIII

EQUIPMENT

Section I. INTRODUCTION

1. General

Current equipment of the German Armed Forces is generally good, despite more than five years of war. Although some German equipment does not reach Allied standards, in the majority of categories it has been found to be as good as, or better than, comparable U. S. items.

2. Design

Much German equipment differs radically in design from Allied counterparts. This does not mean that the functioning of the equipment is in any way inferior; the solution of the problem has been approached from another angle.

3. Shortages

Although acute material shortages sometimes force the employment of substitutes, redesigned German equipment seldom shows impaired efficiency. This is attributable to careful, meticulous planning, and to the production of a surprisingly versatile industry which is controlled completely by the state.

Section II. AUTOMOTIVE EQUIPMENT

1. General

In general, German military automotive equipment consists of adaptations of civilian types, and these in most cases do not reach the high standard of American or British vehicles either in reliability or performance. The German branches of Ford and General Motors appear to have been incapable of reproducing their prototypes with unimpaired efficiency. With half-tracked prime-

movers and personnel-carriers, however, the Germans have excelled; in this class they have produced vehicles which have given excellent service and which are unrivaled for cross-country performance.

2. German Cars

a. LIGHT ARMY CAR (*Volkswagen*). (1) *General*. This four-seat vehicle was developed from the famous "People's Car", which in fact never came into the hands of the German people. The military version has a touring body with a folding top instead of the civilian sedan type body. The *Volkswagen*, the German equivalent of the American "Jeep", is inferior in every way except in the comfort of its seating accommodations.

(2) *Chassis*. The chassis consists of a central, welded-steel tube bifurcating at the rear to support the engine and transmission. The steel floor on both sides of the central member provides the means of supporting the body. The front axle consists of steel tubes which house the two torsion bars of the suspension. The body is of sheet steel.

(3) *Power*. The engine, mounted at the rear, develops 24.5 brake horsepower at 3,300 revolutions per minute. Its capacity is 985 cubic centimeters (60 cubic inches). It is air-cooled and has four cylinders, horizontally opposed in pairs. The gasoline tank is below the instrument panel in front of the right seat. There are four forward speeds, and one reverse. The maximum speed in high gear is about 50 miles per hour. The *Volkswagen* is a four-wheeled vehicle with two-wheel drive.

(4) *Amphibious version*. An amphibious version, known as the *Schwimmwagen* or *le.P.Kw. K.2s*, has an engine of slightly increased capacity (1,131 cubic centimeters or 69 cubic inches). The crankshaft is extended to the rear of the

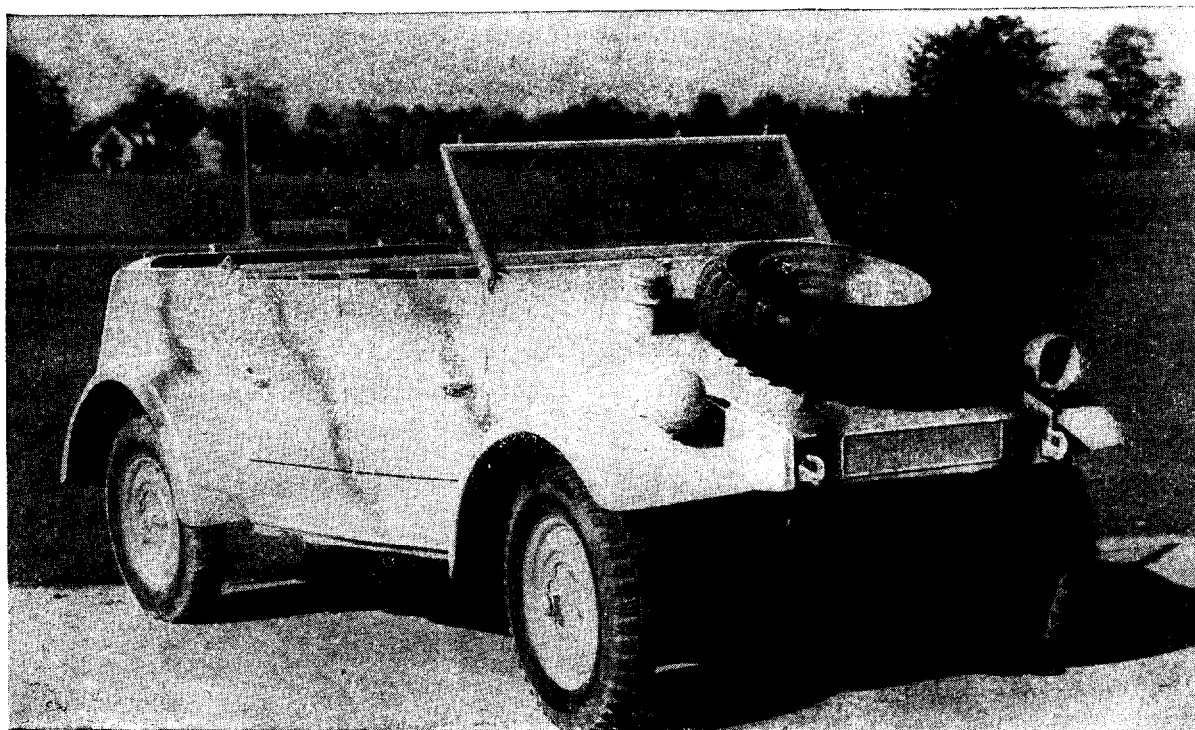
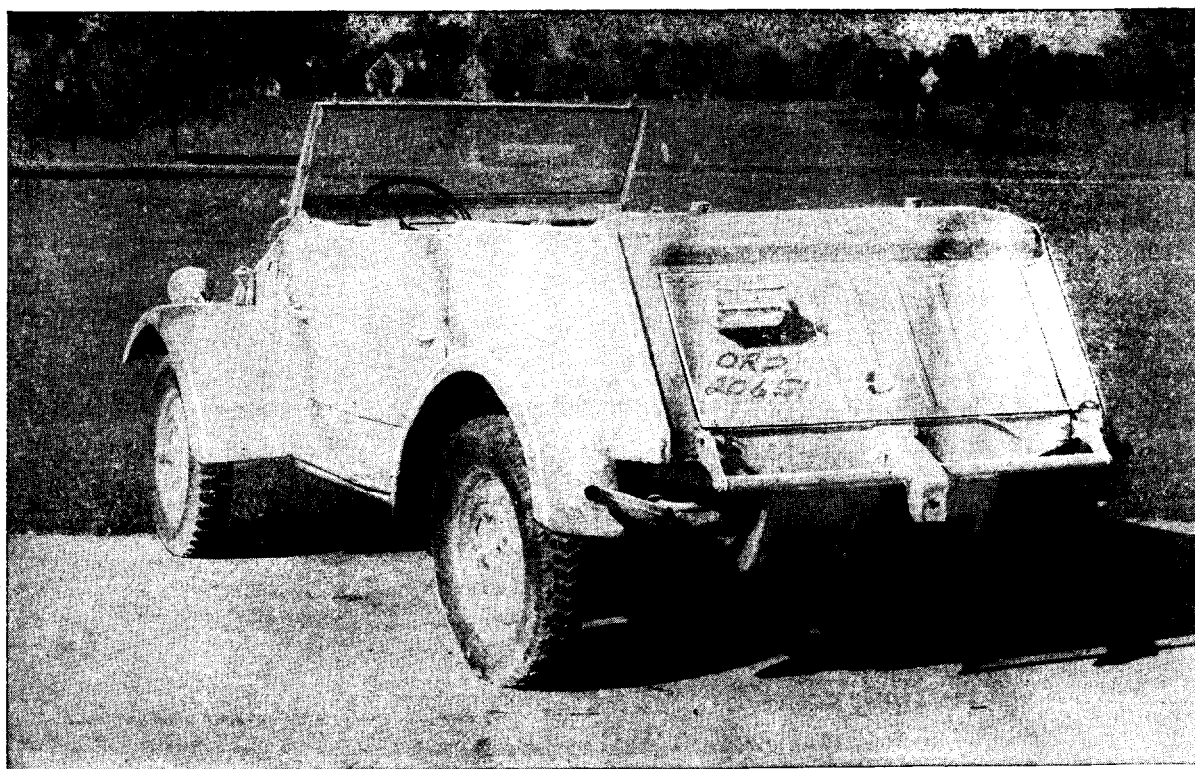


Figure 1.—Small personnel carrier, Volkswagen.

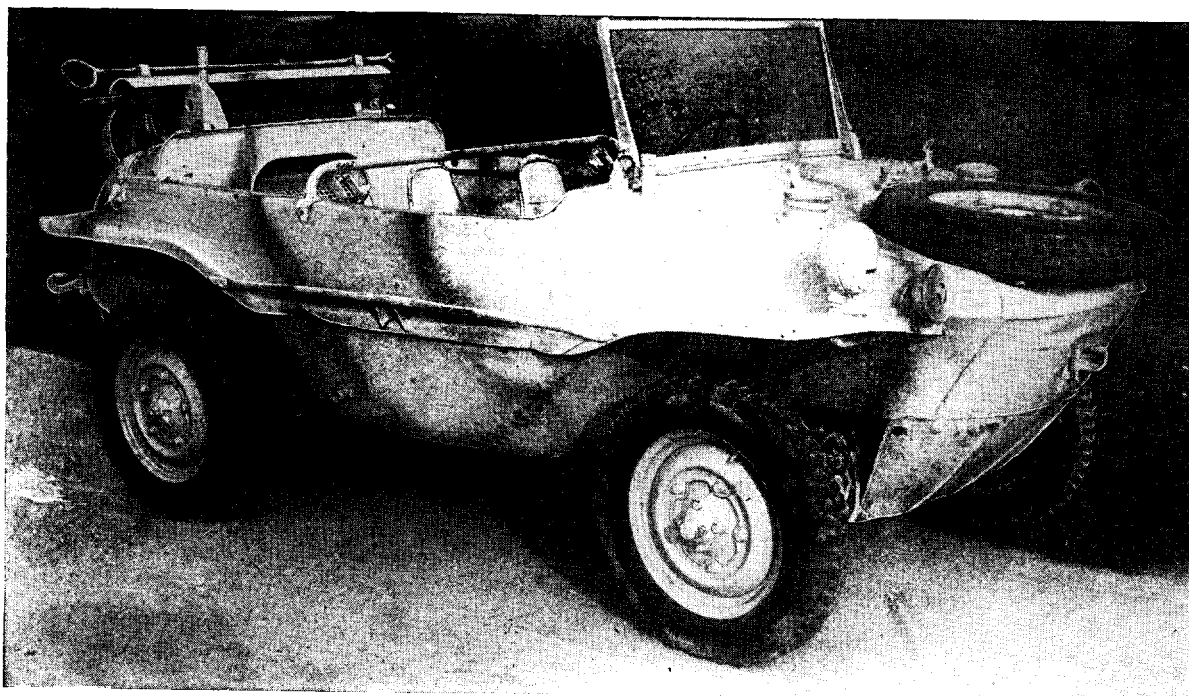


Figure 2.—Amphibious Volkswagen, Schwimmwagen.

body and engages with the propeller-shaft by means of a dog clutch. When traveling overland, the propeller and shaft fold over the back of the vehicle. The body, which resembles a civilian sports car, is of thin welded sheet metal.

b. STANDARD CHASSIS I FOR LIGHT ARMY CAR. (1) *Chassis*. This chassis is of normal type, with a frame of rectangular section, side, and cross members and bracing to support the engine, transmission, and body. The hood is hinged down the center and fastened on each side by two clips. This chassis is used for the four-seat light car (*Kfz. 1*) and for a variety of radio and other special purpose vehicles.

(2) *Engines*. The engine is mounted at the front and may be any of the following types:

(a) *Hanomag 2-Liter (122 cubic inches) Type 20 B*. This is a water-cooled, four-cylinder O.H.V. gasoline engine with dry sump lubrication. It generates 50 brake horsepower at 3,500 revolutions per minute. Water pump, fan, and dynamo are driven by one V-belt from the camshaft.

(b) *B.M.W. 2-Liter (122 cubic inches) Type 325*. This engine is a water-cooled, six-cylinder (in-line) O.H.V. gasoline engine with dry sump lubrication, generating 45 brake horsepower at 4,000 revolutions per minute.

(c) *Stoewer Types R 180 W and AW 2*. These are both water-cooled, four-cylinder O.H.V. gasoline engines with dry sump lubrication. The R 180 W is a 1,750 cubic centimeter (106.75 cubic inches) model generating 43 brake horsepower at 3,600 revolutions per minute, and the AW 2 is a 2-liter (122 cubic inches) engine giving 50 brake horsepower at the same speed.

(3) *Power*. The power train is geared to all four wheels. The vehicle also has four-wheel steering, but the rear wheel steering mechanism may be locked. The gears give five forward speeds and one reverse. Maximum speed is 50 miles per hour. Ignition is by a 12-volt battery and coil. The main gasoline tank (13.25 gallons) is mounted at the rear, and the reserve tank (2.4 gallons) is in the engine compartment.

c. STANDARD CHASSIS I TYPE 40 FOR LIGHT ARMY CAR. This chassis, used for light staff cars and various special purpose vehicles, is practically the same as the Standard Chassis I, but has front wheel steering only. The engine is the Stoewer 2-liter (122 cubic inches) AW 2. The vehicle has a maximum speed of about 50 miles per hour.

d. LIGHT CAR, MERCEDES BENZ TYPE 170 V. (1) *Chassis*. The chassis, used for light staff

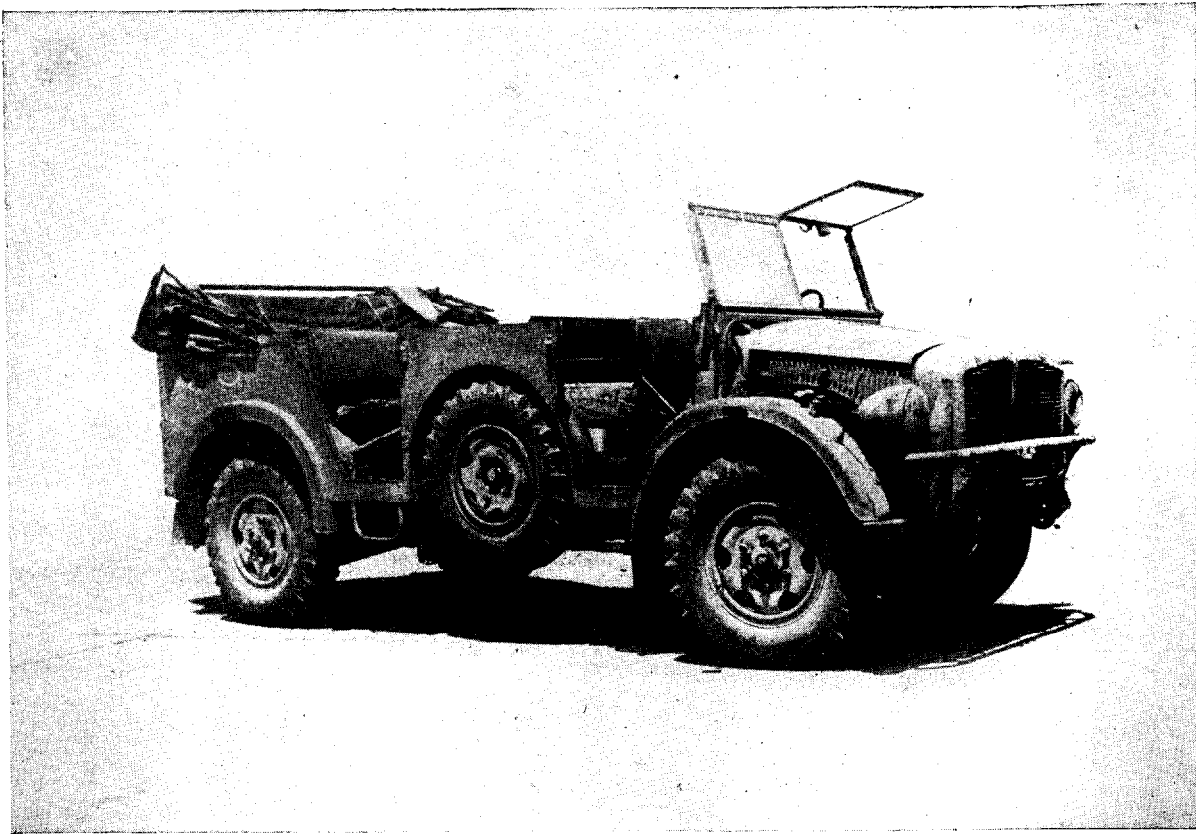


Figure 3.—Medium personnel carrier.

cars and specialized vehicles, is X-shaped and supports the engine at the front. The front wheels are independently sprung by two parallel, semi-elliptic springs crossing the front of the vehicle. The rear wheel suspension is by coil springs. The engine is fitted beneath the hood, which is of normal type.

(2) *Engine.* The engine is the water-cooled, four-cylinder, 1,700 cubic centimeters (103.7 cubic inches) Mercedes Benz Type M 136. This is a side-valve, gasoline engine with an L-shaped cylinder head, with the camshaft and valve gear on the right side. The engine develops about 38 brake horsepower at 3,400 revolutions per minute. The fuel tank, located in the engine compartment, contains 11.5 gallons.

e. **STANDARD CHASSIS FOR MEDIUM CAR.** (1) *Chassis.* This is a conventional chassis used for staff cars, radio vehicles, and other specialized types and consisting of two parallel side members and various cross members and brackets. The engine is fitted at the front, and the wheels are sprung independently by two coil springs with double-action, hydraulic shock absorbers

The spare wheels are carried one on each side of the chassis on stub axles to prevent bellying when traveling over rough ground.

(2) *Engines.* The engine may be either of two types: Horch V-8 Type 901 (a water-cooled, 3.5-liter (213.5 cubic inches) gasoline engine developing 82 brake horsepower at 3,600 revolutions per minute), or an Opel straight-six (a water-cooled, 3.6 liter (219.6 cubic inches) O.H.V. gasoline engine developing 68 brake horsepower at 2,800 revolutions per minute). There are two gasoline tanks. The main tank, holding 18.7 gallons, is suspended in the center of the chassis frame, and the reserve tank holding 10.8 gallons, is at the rear. The main gear box has four forward speeds and one reverse, with an auxiliary gear box giving two ratios: normal and cross-country. All four wheels are driving wheels.

f. **STANDARD CHASSIS II FOR HEAVY CAR.** (1) *Chassis.* There are actually three known models of this chassis, all being similar in general appearance. Model EGa has stub axles carrying the spare wheels to assist in crossing rough ground, and four-wheel steering. The steering

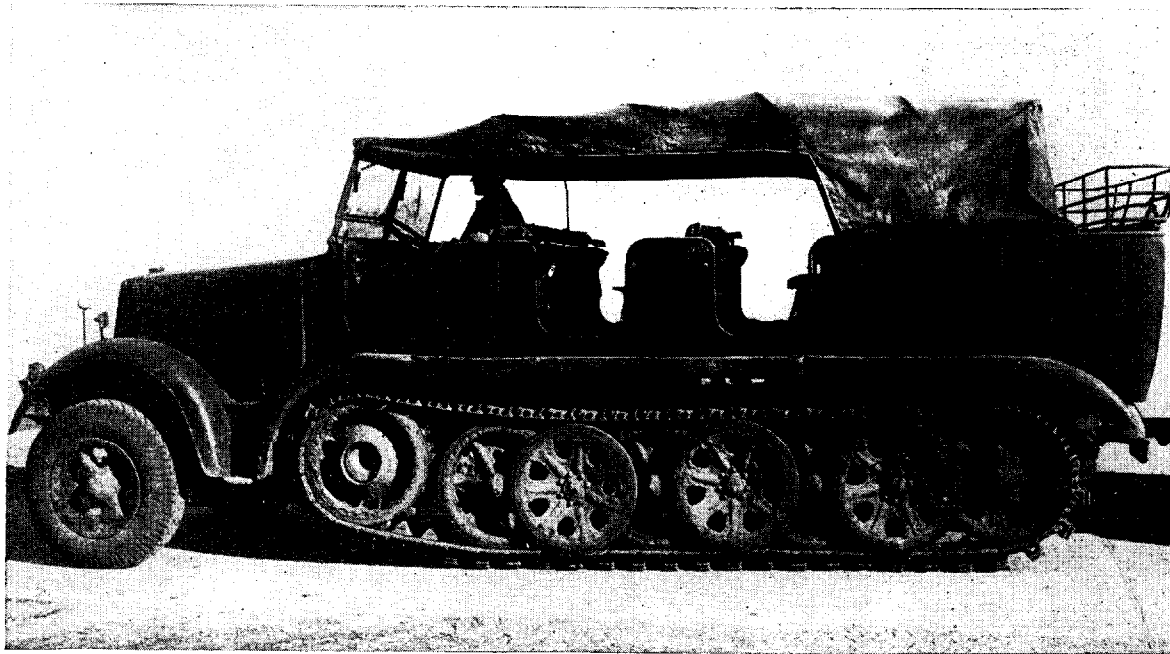


Figure 4.—Medium Half-tracked prime mover (8-ton).

mechanism for the rear wheels can be locked. Model EGb has front wheel steering only. Model EGd has no anti-bellying support axles. The body usually fitted is a four-door touring type of clumsy appearance. The vehicle is used for a variety of purposes, including an artillery prime mover for light guns.

(2) *Engine.* The engine is the Ford 3.6-liter (219.6 cubic inches) V-8, developing 78 brake horsepower at 3,600 revolutions per minute. This is a side-valve model with L-type cylinder heads. There are five forward speeds and one reverse. The main (14.5 gallons) and subsidiary (17 gallons) gasoline tanks are supported within the chassis frame.

3. German Trucks

a. OPEL "BLITZ" 3-TON TRUCK TYPE 3.6-36 S.

(1) *Chassis.* This vehicle, employed principally as a general purpose truck, has a variety of specialized bodies. There are actually three models: the 3.6-36 S, the original Chevrolet-type commercial vehicle; the 3.6-36 S (army model), which is modified to meet army specifications; and the 3.6-47 which is intended primarily for coaches and has a lengthened chassis. The vehicle has a normal rectangular type chassis, supporting the engine at the front.

(2) *Power.* The engine is a water-cooled, straight-six O.H.V. gasoline unit of 3.6 liters

(219.6 cubic inches) capacity, developing about 68 brake horsepower. The gasoline tank (21.6 gallons) is situated under the driver's seat. The gear box gives five forward speeds and one reverse. The two rear wheels are the driving wheels.

b. OPEL "BLITZ" 3-TON TRUCK (TYPE 6700 A). This is essentially the four-wheel drive version of the type 3.6-36S. The drive is taken from the five-speed main gear box to a transfer case. The transfer gears have two positions: one for roads and one for cross-country travel.

c. FORD 3-TON TRUCK (TYPES G 917 T AND G 997 T). These are both commercial models with two-wheel drive, slightly modified to meet army specifications. Both are powered by V-8 water-cooled gasoline engines developing about 78 brake horsepower. In the model G 917 T the capacity is 3.6 liters (219.6 cubic inches), increased to 3.9 liters (237.9 cubic inches) in the G 997 T by enlarging the bore. The gear box gives four forward speeds and one reverse. There is also a type G 987 T, a purely commercial model but very similar to the two army models.

d. MERCEDES BENZ 3-TON TRUCK (TYPE LCF 3000). (1) *Chassis.* The chassis is of welded construction with pressed steel cross-members. The engine is mounted at the front beneath a hood of normal type. Both front and rear axles are supported by two longitudinal, semi-elliptic

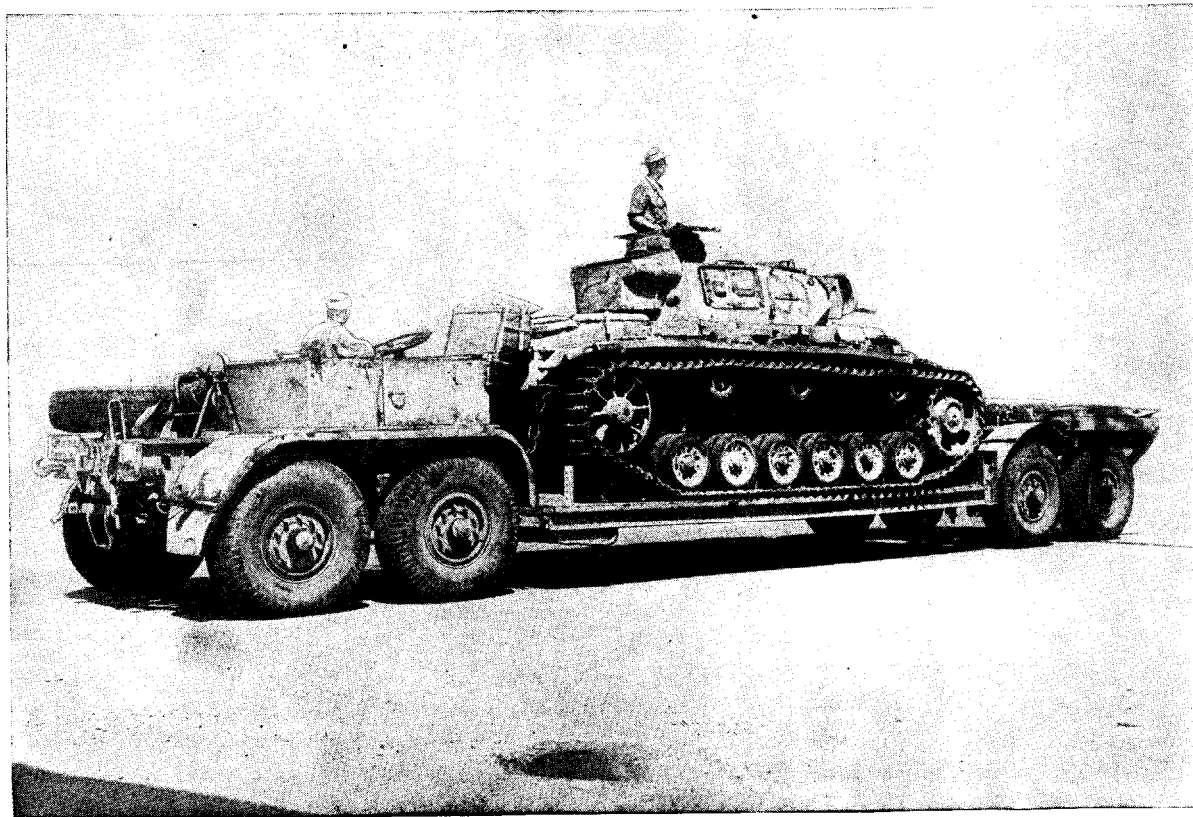
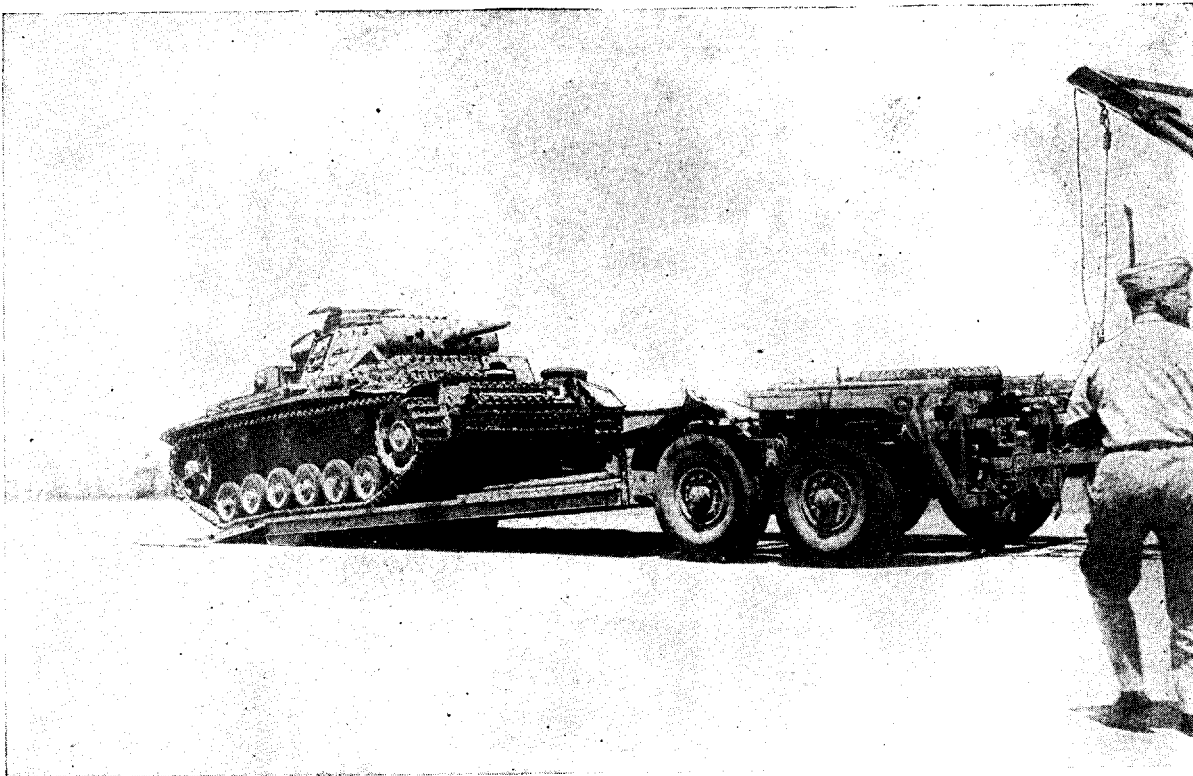


Figure 5.—22-ton tank transport trailer.

springs, each of which has a two-way shock absorber.

(2) *Power.* The Diesel engine is a four-cylinder, O.H.V., water-cooled model of about 5 liters (305 cubic inches) capacity. The gear-box gives four forward speeds and one reverse. There is an auxiliary gear box for selecting road or cross-country gear ratio. The driving power is carried to only two of the four wheels. Similar vehicles of Mercedes Benz manufacture also exist up to the 10-ton class. Some of the smaller ones may be found with gasoline engines, but in all the larger sizes only Diesels are used.

e. BÜSSING-N.A.G. 4½-TON DIESEL TRUCK. This is a conventional type of truck which performs satisfactorily under test. At the governed speed of 1,740 revolutions per minute, 93 brake horsepower was developed. Over a 100-mile road circuit with heavy traffic, the vehicle averaged 21.1 miles per hour, and the fuel consumption averaged 8.72 miles per gallon. The vehicle, during the test, carried a load of 6¾ tons without any difficulty.

f. HEAVY WHEELED PRIME MOVER *Radschlepper Ost*. (1) *Description.* This is a heavy prime mover with four large wheels, intended for use on the Russian front. This vehicle should not be confused with the *Raupenschlepper Ost*, a fully-tracked prime mover also intended for use on the Russian front.

(2) Specifications.

Length	20 feet.
Width	7 feet 4 inches.
Height	10 feet.
Wheels (steel)	Four, 4 feet 10 inches in diameter.
Engine	4-cylinder, in-line, air-cooled, 90 horsepower.
Fuel	Gasoline.
Capacity	6,024 cubic centimeters. (367.46 cubic inches.) (with 2-cylinder, air-cooled, 12 horsepower auxiliary starter engine).
Drive	4 wheel, with locking differential.
Gears	Five forward, one reverse.
Speed, road	6 miles per hour (average).
Weight unloaded	9 tons.
Useful load	4.5 tons.
Trailed load	5.6 tons.
Winch capacity	5.6 tons.

g. HALF-TRACKED PRIME MOVERS AND PERSONNEL CARRIERS. These vehicles form the most successful series produced by the Germans, and have multifarious uses. Figure 60 gives brief comparative details of each. The dates given in column 3 refer to the presumed date of introduction. In the same column, the initial letters in the manufacturer's type are the initials of the original manufacturer. Thus DB stands for Daimler Benz, Bn for Büssing N.A.G., HL for Hansa-Lloyd (Borgward), D for Demag, H for Hanomag, and F for Famo. The original manufacturer may not be the exclusive maker of a particular type of vehicle, for certain types may be manufactured by several firms.

COMPARATIVE TABLE OF VARIOUS TYPES OF GERMAN HALF-TRACKED VEHICLES.

Zg.Kw. TYPE	Sd. Kfs. No.	Manufacturer's type	Maybach Engine type	Gearbox type	Braking system	Suspension	Clutch
1 ton	10	D7 (1938/9)	NL 38 TRKM or HL 42 TRKM	Maybach pre-selective semi-automatic SRG 102128H.	ATE Hydraulic foot brakes. Hydraulic steering brakes. Handbrake works mechanically on the steering brakes.	Full torsion-bar. (Idler not sprung, but fitted with shear-bolt safety device).	Fichtel and Sachs Mecano type PF 220 K.
1 ton	10	D7 (1940)	as above	Maybach Variorex VG102128H	as above	as above	as above
Light armored carrier on Zg.Kw. 1-ton chassis.	250 252 253	D7p (1940)	HL 42 TRKM	as above	as above	Note: One pair of bogies less than on Zg.Kw. 1-ton (Sa.Kfs. 10).	as above
3 ton	11	kl 6 (1938)	NL 38 TUKR or HL 42 TUKRM	Normal 4-speed type with auxiliary gearbox.	Mechanical hand and steering brakes. Mechanical servo-assisted footbrake.	Full torsion-bar. (Idler not sprung, but fitted with shear-bolt safety device).	Fichtel and Sachs Mecano type PF 220.
Medium armored carrier on Zg.Kw. 3-ton chassis.	251	kl 6p (1938)	NL 38 TUKRRM or HL 42 TUKRRM	as above	as above	as above	
as above	251	kl 6p (1940)	HL 42 TUKRRM	as above	as above		
as above	251	H kl 6p (1940)	NL 38 TUKRRM or HL 42 TUKRRM	as above	as above		Fichtel and Sachs Mecano type PF 220 K.
5 ton	6	BNL7 (1936)	NL 38 Spezial.	Zahnradfabrik Aphon gearbox type G.45 V. (non-synchromesh).	Mechanical steering brakes. Bosch pneumatic hand and footbrakes.	Bogies with leaf-springing in pairs. Idler sprung with 2 short torsion-bars, fixed in center of tube.	as above
5 ton	6	BNL8 DBL8 (1938/39)	NL 38 TUK or NL 38 TUKRM		Mechanical hand and steering brakes. Bosch pneumatic footbrake.	Full torsion bar. (Idler not sprung, but fitted with shear-bolt safety device).	as above

Footnote at end of table.

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COMPARATIVE TABLE OF VARIOUS TYPES OF GERMAN HALF-TRACKED VEHICLES.—Continued

Zg.Kw. type	Sd. Kfz. No.	Manufacturer's type	Maybach Engine type	Gearbox type	Braking system	Suspension	Clutch
5 ton	6	BN 9 (ca. 1940)	HL 54 TUKRM		Bosch pneumatic foot brake. ATE hydraulic steering-brakes. Mechanical handbrake.	as above	as above
8 ton	7	KM m 8 (1935)	HL 52 TU	Zahnradfabrik ZG 55.	Mechanical steering and hand-brakes. Knorr pneumatic foot-brakes.	Bogies with leaf-springing in pairs. (Spiral springing on idler).	
8 ton	7	KM m 11 HL m 11 (ca. 1939)	HL 62 TUK	"Non-synchronized".	Mechanical hand and steering brakes. Bosch pneumatic foot brake.	Bogies with leaf-springing in pairs. (Torsion-bar springing on idler). <i>Note:</i> This model was being made up to 1942, but some later models have full torsion-bar suspension.	Mecano type K 230 K.
12 ton	8	DBs 8 (1938)	DSO/8		Bosch pneumatic foot brake. (Mechanical steering brakes).	Bogies with leaf-springing in pairs. Torsion-bar springing on idler.	Mecano type LA 80 H.
12 ton	8	DB 9 (1939)	HL 85 TUKRM.		Bosch pneumatic foot brakes. ATE hydraulic steering brakes.	as above	
12 ton	8	DB 10 (1939/40)	HL 85 TUKRM		Mechanical hand-brake. Bosch pneumatic foot-brake. Hydraulic steering brakes.	Full torsion-bar. (Idler not sprung, but fitted with shear-bolt safety device).	Mecano LA 65/80 B.
18 ton	9	F-2 (1938)	HL 98 TUK	Zahnradfabrik Type G 65 VL230.	Mechanical hand and steering brakes. Bosch pneumatic foot brake.	as above	Mecano LA 65/80.
18 ton	9	F-3 (1939)	HL 108 TUKRM	as above	as above	as above	Mecano LA 80.

Figure 60.

Section III. ARTILLERY FIRE CONTROL EQUIPMENT

I. On-Carriage Fire Control Equipment

a. GENERAL. German on-carriage fire control devices for field artillery, antitank artillery, self-propelled artillery, and tanks, are generally similar for all pieces of each class. All are characterized by excellent workmanship and ease of operation.

b. FIELD ARTILLERY. (1) *General*. Field artillery on-carriage fire control equipment is designed for both direct and indirect laying. Eight mounts of azimuth compensating type automatically allow for trunnion cant when cross-leveled. The angle-of-site mechanism is graduated from 100 to 500 mils, 300 mils representing normal. The gun is laid at the quadrant elevation on the sight by matching two arms, one moving with the gun, the other with the sight bracket. Fire adjustment depends on the accuracy of this rather difficult pointer matching. Range drums, graduated to suit the particular pieces on which they are mounted, are operated by handwheels.

(2) *Panoramic telescope M32*. This is the

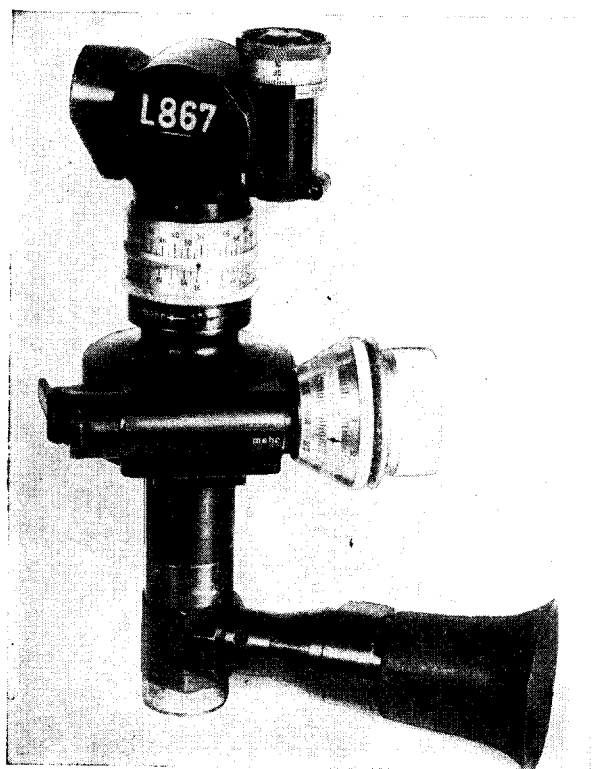


Figure 7.—Panoramic Telescope M32.

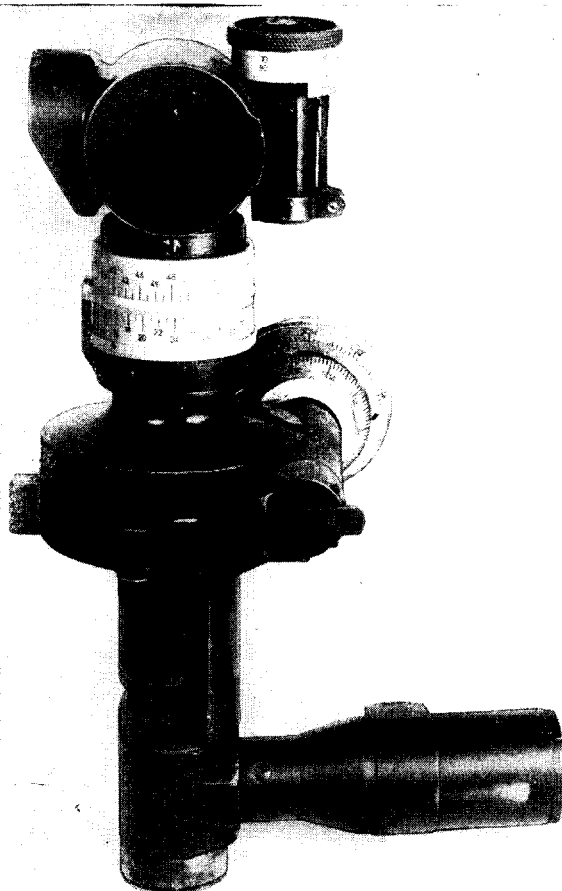


Figure 8.—Panoramic Telescope M32K.

standard German field artillery sight, and consists of the following:

(a) *Stem*. A stem fits into a tubular socket on the sight bracket of the gun.

(b) *Rotating head*. Main and slipping azimuth scales are attached to the rotating head. It can be rotated by operating a quick release, or, for finer adjustment, by micrometer heads.

(c) *Azimuth scales*. The main scale is fixed relative to the rotating head. It is graduated in hundreds of mils, numbered by twos, from zero to 6,400. The slipping scale follows every movement of the main scale, but can be rotated independently. It is graduated in hundreds of mils, numbered in twos from zero to 32 right and left. A micrometer drum, with fixed and movable scales, works in conjunction with main and slipping scales. Both are graduated in mils, numbered by tens. The index is on a fixed ring between the two scales.

(d) *Elevation micrometer*. Turning this micrometer head tilts the object glass, raising or

GERMAN TANK AND ARMORED CAR SIGHTS—TURRET SIGHTING TELESCOPES

TYPE	USED ON	GUNS AND AMMUNITION	Range Scales (Meters)	Magnification (X)	Field (Degrees)	Overall length (less eye guard) (inches)	Weight (pounds)	Exit Pupil distance (mm.)	Entrance Pupil diameter (mm.)	REMARKS
T.Z.F.2 and 2X.	Pz.Kpfw.I. Models A and B.	7.92 mm MG 13.	800	2.5	28	19	19	5.5	—	It is not known with what gun the T.Z.F.2 was used, nor in which vehicle. Monocular.
T.Z.F. 3a.	4-wheeled armored car. Sd.Kfz.222 and semi-tracked A.C. Sd.Kfz. 250/9.	2 cm Kw.K. 38. 7.92 mm M.G. 34.	1200	—	—	—	—	—	—	Little is known about this telescope. Monocular.
T.Z.F.4.	Pz.Kpfw. II Models A to C.	2 cm Kw.K. 30. 7.92 mm M.G. 34.	1200	2.5	25	22.5	20	7	17.5	First confirmed Leitz design. Monocular.
T.Z.F.4/36 and 4/38.	Pz.Kpfw.II Model F.	2 cm Kw.K. 30. 7.92 mm M.G. 34.	1200 800	2.5	25	22.5	21	7	17.5	The range of 800 metres applies to T.Z.F. 4/36 and that of 1200 metres to T.Z.F. 4/38. Monocular.
T.Z.F. 5a.	Pz.Kpfw. III Models A to D.	3.7 cm Kw.K. (AP and HE). 7.92 mm M.G. 34.	2000 800	2.5	25	32.25	24	5	12.5	Monocular.
T.Z.F. 5a. (Vorl). 5 cm.	Pz.Kpfw. III Model E, etc. (See Remarks).	5 cm Kw.K (AP and HE). 7.92 mm M.G. 34.	2000 1500	2.5	25	32.25	21.5	5	12.5	Monocular, Modified T.Z.F. 5a, superseded by T.Z.F. 5d.
T.Z.F. 5b.	Pz.Kpfw. III with 7.5 cm. Kw.K. Models J to N. Pz.Kpfw. IV Models B to F.	7.5 cm Kw.K. 7.92 mm M.G. 34.	2000 800	2.4	23.5	32.25	21.5	5	12.5	Monocular.
T.Z.F. 5b/36.	Pz.Kpfw. IV. Models B to F.	7.5 cm Kw.K. 7.92 mm M.G. 34.	2000 800	2.4	23.5	32.25	23	6	14.4	Monocular.
T.Z.F. 5d.	Pz.Kpfw. III. Models F and J.	5 cm Kw.K. (APC and HE) 7.92 mm M.G. 34.	3000 1500	2.4	25	31.8	20.13	5.5	13.2	Monocular.
T.Z.F. 5.	Pz.Kpfw. III Models L and M.	5 cm Kw.K 39 AP or APCHE 7.92 mm M.G. 34.	1500 3000 1200	2.4	25	31.8	20.13	5.5	13.2	Monocular.
T.Z.F. 5f (Vorl)	Pz.Kpfw. IV Models F2 to II.	7.5 cm Kw.K. 40 APCBC HE AP40 7.92 mm M.G. 34.	2500 3300 1500 (See Remarks)	2.4	25	31.8	20.13	5.5	13.2	Monocular. The HE scale serves for the machine gun also.

Figure 9.

GERMAN TANK AND ARMORED CAR SIGHTS—TURRET SIGHTING TELESCOPES—Continued

1 MARCH 1945

TYPE	USED ON	GUNS AND AMMUNITION	Range Scales (Meters)	Magnification (X)	Field (Degrees)	Overall length (less eye guard) (inches)	Weight (pounds)	Exit Pupil distance (mm.)	Entrance Pupil diameter (mm.)	REMARKS
T.Z.F. 5f. 1.	Pz.Kpfw. IV Models G to K.	7.5 cm Kw.K. 40 APCBC HE AP 40 7.92 mm M.G. 34.	3000 4000 1500 (See Remarks)	2.4	25	32	26	5.8	13.9	Monocular. The HE scale serves for the machine gun also.
T.Z.F. 6.	8-wheeled armored car and Pz. Sp. Wg. II (Luft) Sd. Kfz. 123.	2 cm Kw.K. 30 and 38, and 7.92 mm M.G. 34.	1200	2.4	22	28.4	21	5	12	Monocular.
T.Z.F. 6/38.		2 cm Kw.K. 38 and 7.92 mm M.G. 34.	1200	2.5	25					Little known about this telescope but known dimensions agree with those for the T.Z.F.6. Monocular.
T.Z.F. 9b.	Pz.Kpfw. Tiger Model E.	8.8 cm Kw.K. 36. 7.92 mm M.G. 34.	4000 1200	2.4	26	32.5	37	6	15	Binocular. Adjustable interocular distance.
T.Z.F. 9d.	Pz.Kpfw. Tiger Model B.	8.8 cm Kw.K. 43 APCBC HE 7.92 mm M.G. 34.	3000 5000 (See Remarks)							Monocular. The HE scale is believed to serve for the machine gun also.
T.Z.F. 12.	Pz.Kpfw. Panther Model D.	7.5 cm Kw.K. 42 APCBC (L/70) HE AP 40. 7.92 mm M.G. 34.	3000 4000 2000 (See Remarks)	2.5	29	45.1	63.88	6.2	15	Binocular. Light and dark filters fitted. The HE scale serves for the machine gun also.
T.Z.F. 12a.	Pz.Kpfw. Panther Models A and G.	As above.	3000 4000 2000 (See Remarks)	2.5 5	19 15	44.5	44	6.2 3.1		Monocular, dual magnification.

HULL MACHINE GUN TELESCOPES

K.Z.F. 1.	Early models of most tanks.	7.92 mm M.G. 34. (gimbal mountings).	200 (fixed)	1.8	18			5	—	Cranked, monocular, moving-eyepiece type.
K.Z.F. 2.	Pz.Kpfw. I, Commander's. Pz.Kpfw. II, Flamethrower. Pz.Kpfw. III, Commander's and Models F to J. Pz.Kpfw. IV, Tiger and Panther.	7.92 mm M.G. 34. (gimbal and ball mountings).	200 (fixed)	1.75	18	14.13	7	5	—	Cranked, monocular, moving-eyepiece type.

Figure 10.

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lowering the line of sight. The elevation scale is graduated in hundreds, from 100 mils to 500 mils, with 300 as normal. The micrometer is graduated in single mils numbered in tens.

(e) *Eyepiece.* This is at the end of an arm and can be turned in any direction. The reticle which may be illuminated has an interrupted vertical line with an inverted "V" for elevation. Late models of the *M.32* as well as *M.32 K* sights have a horizontal scale added to the reticle.

(f) *Characteristics, M.32 and M.32 K.*

Power4 x.
Field of view10°.
Diameter of exit pupil...1.8 inches.
Overall length6.25 inches.
Weight5 pounds.

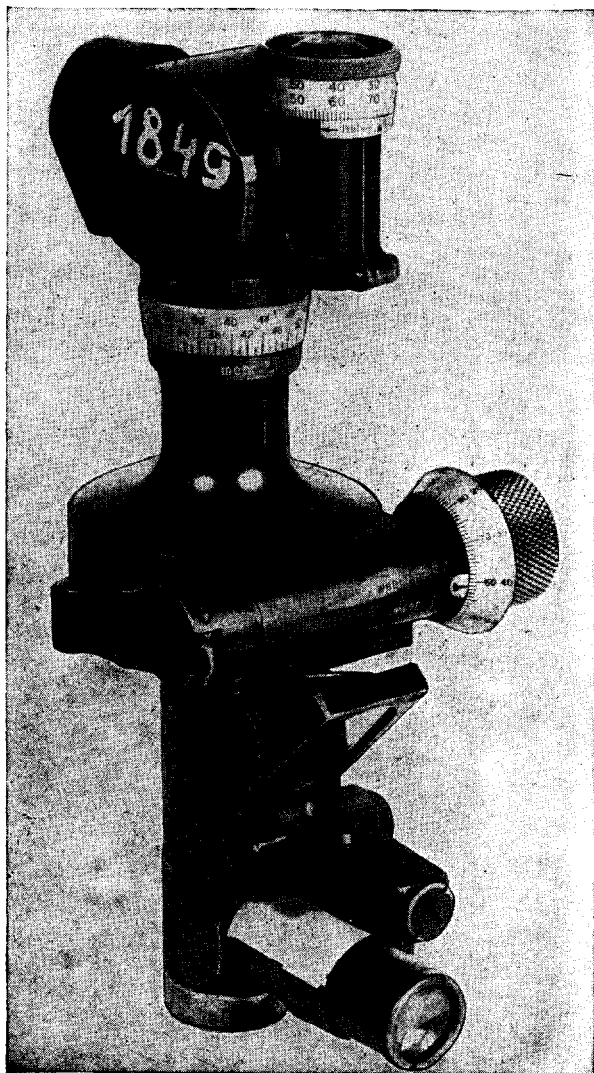


Figure 11.—Panoramic Telescope M16/18.

(3) *Panoramic Sight M.16/18.* (a) *Description.* The *M.16/18* sight differs from the *M.32* as follows:

It has no slipping scales.

When the azimuth scale is set at zero, the rotating head forms an angle of 90 degrees with the eye piece.

A cross-level vial assembly is secured to the shank. It is adjusted by turning an eccentric plug.

(b) *Characteristics.*

Power4 x.
Field of view10°.
Diameter of exit pupil...1.5 inches.
Length Over-all6.25 inches.
Weight4 pounds 5 ounces.

c. *ANTITANK GUNS.* (1) *General.* All German antitank-gun sight mounts have facilities for applying range, and most have a means for applying lateral deflection. Characteristics of various sights are:

(a) *2 cm S.Pz. B41.* Open sights "U" and acorn. Graduations for range, but no mechanical arrangement for applying deflection. Telescope sight fits into a trigger housing on sight mount.

(b) *5 cm Pak 38.* The sight incorporates lateral deflection gear and means for adjusting line and elevation. Range drum is graduated to 2,400 meters (HE) and 1,400 meters (AP).

(c) *7.5 cm Pak 40.* As for *5 cm Pak 38* but graduated to 2,800 mils (HE) and 1,400 mils (AP).

(d) *7.62 cm Pak 36 (r).* Rocking bar reciprocating; range indicator graduated to 6,000 meters (APCBC) and 2,000 meters (AP 40). Elevation indicator graduated in meters for three types of projectiles and in mils up to 800.

(e) *7.5/5.5 cm Pak 41.* Range drum with five scales. The first is graduated in mils, the remaining four in meters with decreasing range limits; believed used as muzzle velocity decreases with rapid wear of the tapered bore. A deflection mechanism is located below the range setting handle.

(f) *8.8 cm Pak 43/41.* There are two telescopic mounts side by side on the left. One, of rocking bar type, is for antitank use, and the other, similar to the sight mount of the *10.5 cm le. F.H.18* is for indirect laying.



Figure 12.—Sight mounts. (Left) For 10.5 cm Howitzer on Pz. Kpfw. III chassis (Stu. II42). (Right) For 7.5 cm Pak 40 on Czech (38t) tank chassis.

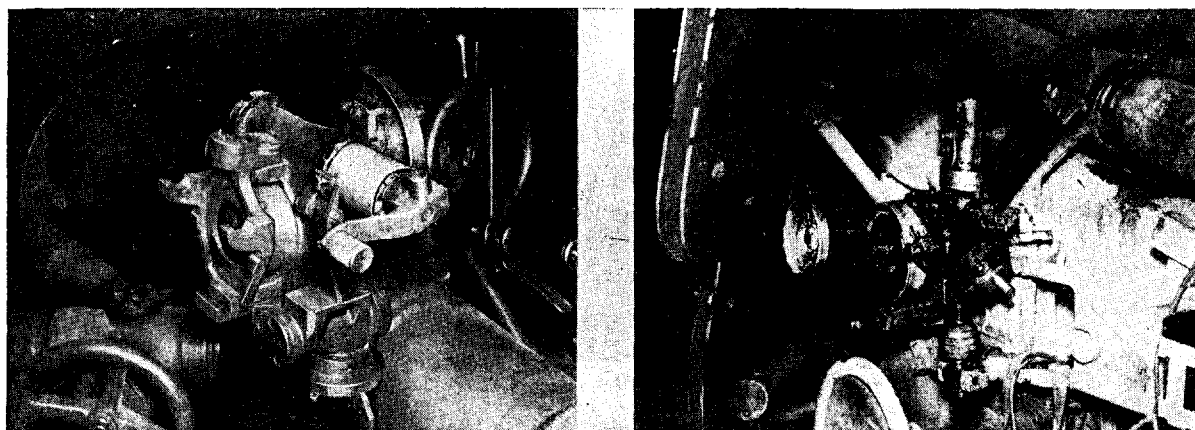


Figure 13.—Sight mounts. (Left) For 75/55 mm Pak 41 Gun. (Right) For 8.8 cm Pak 43/41 Gun.

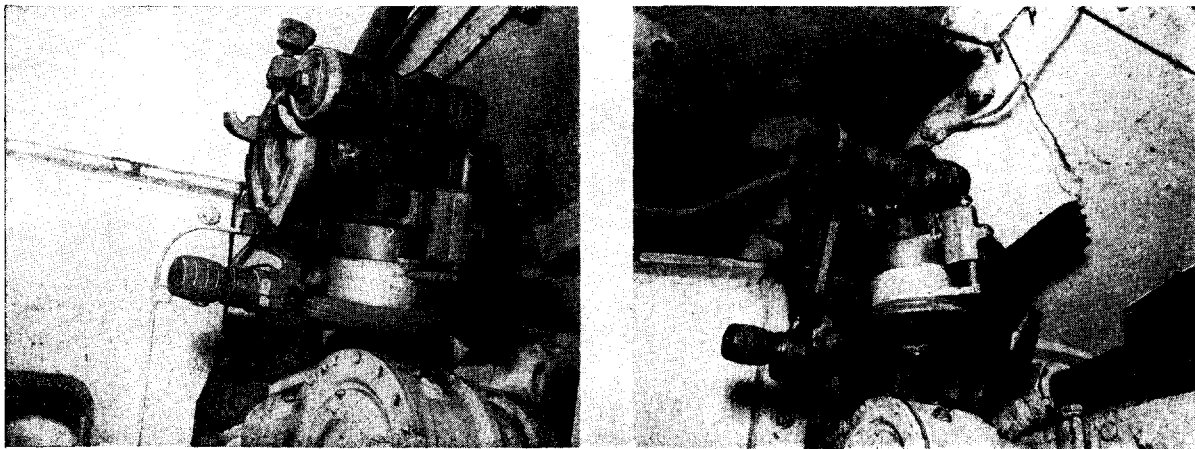


Figure 14.—Sight mounts (Left) For 7.5 cm (Stu. K40) Pz. Kpfw. III chassis. (Right) For 7.5 cm on Pz. Kpfw. III w/o rotary cupola.

(2) Zielfernrohr, Z.F. 38/II S.v.o.4 This is the sight now used with all antitank guns. It has one main graduation with three secondary graduations on each side, and a vertical line between the

conical reticles. The angle from conical to vertical reticle is 4 mils, giving a maximum lay-off of 24 mils on each side. The field of view is 8 degrees, and magnification three-fold.

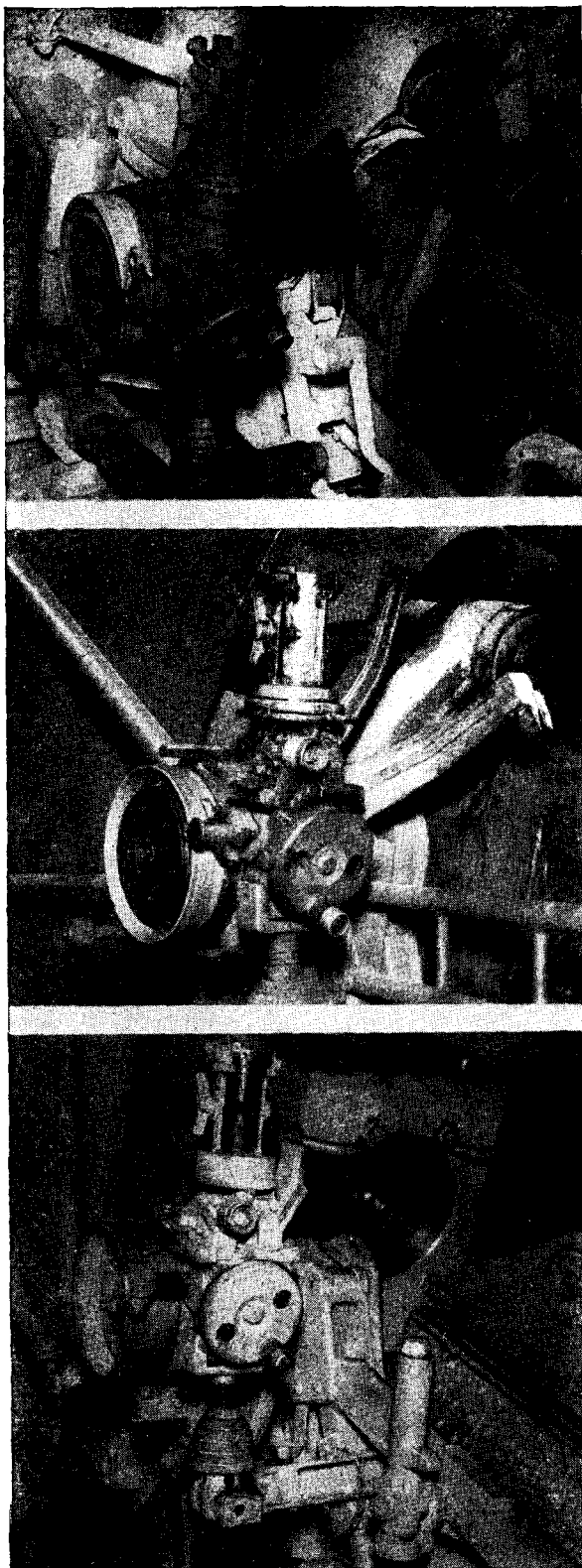


Figure 15.—Sight mounts. (Top) For 7.5 cm Howitzer. (Center) For 10.5 cm LFH 18 Howitzer. (Bottom) For 15 cm SIG 33 Howitzer.

(3) *Aushilfsrichtmittel 38*. This is the sight used for indirect laying of antitank guns. It consists of a tangent elevation drum, bearing ring, and telescopic sight with 10-degree field of view and 3-power magnification. The tangent elevation drum is graduated from zero to 1,300 mils by hundreds, and the bearing scale from zero to 6,400 mils in hundreds. Both have micrometer adjustments for zero to 100 mils.

d. SELF-PROPELLED ARTILLERY. Most German self-propelled assault and antitank guns of 75 mm or more caliber use the *Sfl. Z.F.* series of direct-laying telescopes. Excepting the *Sfl. Z.F. 5*, on the *8.8 cm Pak 43/3 (1./71)* on *Pz. Jag. Panther*, they are mounted on a *Zielfinrichtung 37 (Z.E. 37)* sight bracket. This sight bracket has cross-levelling deflection and range adjustments. Since 1942 panoramic sights issued for self-propelled artillery have been reduced to one for each two guns.

e. TANK AND ARMORED CAR SIGHTS. (1) *General*. German tank and armored car sights are of articulated stationary eyepiece type, with vertically moving reticles. They are for direct laying, and consist of two main parts: objective tube and reticle box, which move with the gun; and the eyepiece tube, carrying the range control, which remains stationary. (Details of tank and armored car sights are given in Figure 9.)

(2) *Range scales*. Range scales (including an allowance for jump) consist of a series of small circles about the optical axis, graduated in hundreds of meters, and numbered every 200 meters. Those for various projectiles are marked accordingly. Ranges are read against a fixed translucent pointer at the top of the field of view.

(3) *Reticle markings*. Reticle markings consist of a large central triangle, or inverted V, with three smaller triangles on each side at 4-mil intervals. The center apex is the normal aiming point. Zeroing knobs for line ("*Seite*") and elevation ("*Höhe*") and reticle illumination are provided. The optical and mechanical joint is a dust proof, water-tight prism system, usually limited to -20 degrees depression and $+30$ degrees elevation.

(4) *Machine-gun sights*. Machine-gun sights on tanks and armored cars are fixed in gimbal or ball mounts, with the optical axis offset so that the line of sight is close to the machine gun when it passes through the ball. The reticle has no range or deflection settings. Zeroing adjustments are provided, however, as well as illumination.

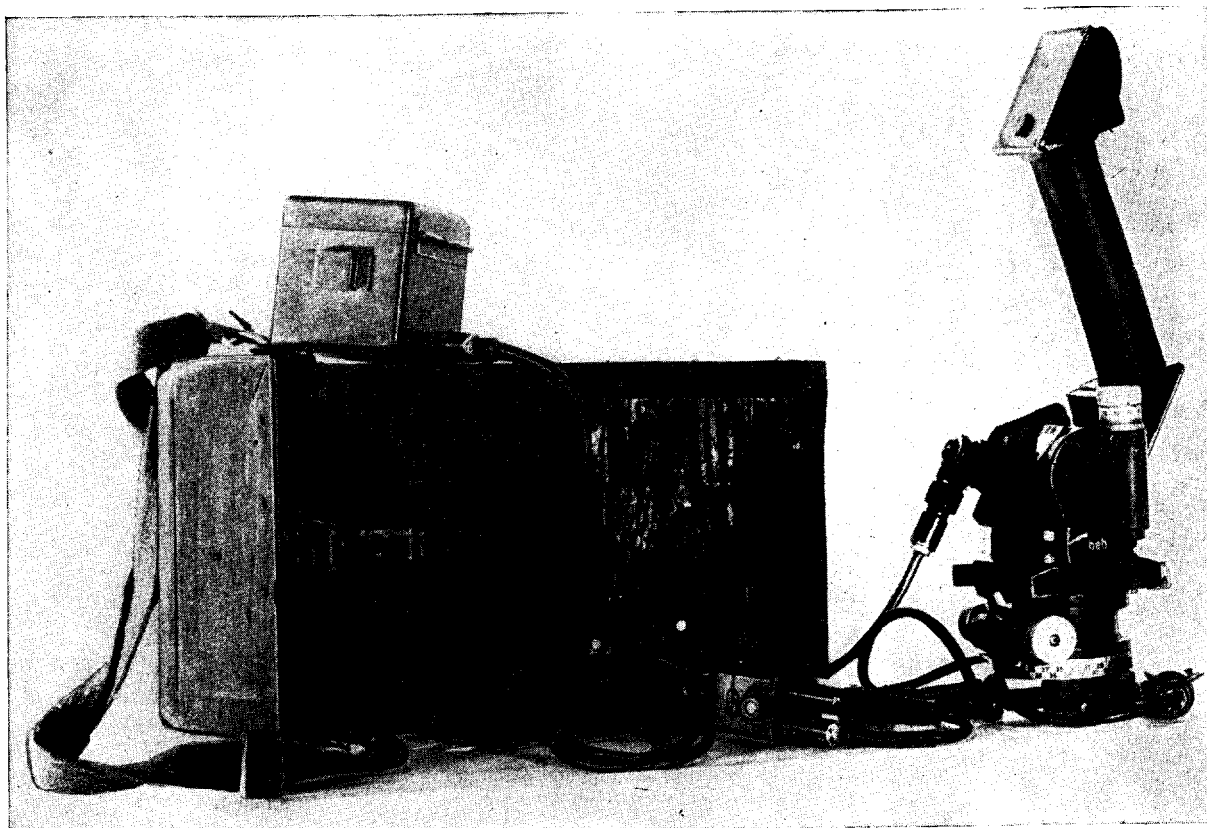


Figure 16.—Aiming Circle, Rkr 31, with case and illuminating apparatus.

2. Off-Carriage Fire Control Equipment

a. GENERAL. Like their other optical instruments, German off-carriage fire control equipment is superior in design and workmanship. Most instruments which are quite similar to our own could be used effectively by Allied troops.

b. *Winkelmesser 35 (W.M. 35)*, GUNNER'S QUADRANT. (1) *General*. This gunner's quadrant is simple and well constructed. The frame contains an elevation arc with a scale graduated in ten-mil units from zero to 1,000 mils in black numerals, and from 600 to 1,600 mils in red. The quadrant arm carries a spirit level and is provided with coarse and fine screw-type adjustments.

(2) *Characteristics*:

Weight	1.75 pounds.
Height	4.63 inches.
Width	0.94 inch.
Length	4.63 inches.

c. *Richtkreis 31 (Rkr. 31)*, AIMING CIRCLE. (1) *General*. Material, workmanship, and design of the Rkr. 31 are excellent, and no expense has been spared in its production. It is con-

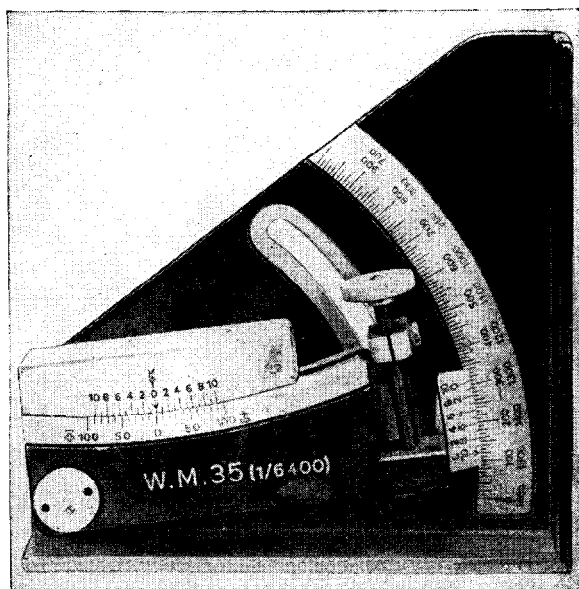


Figure 17.—Gunner's quadrant.

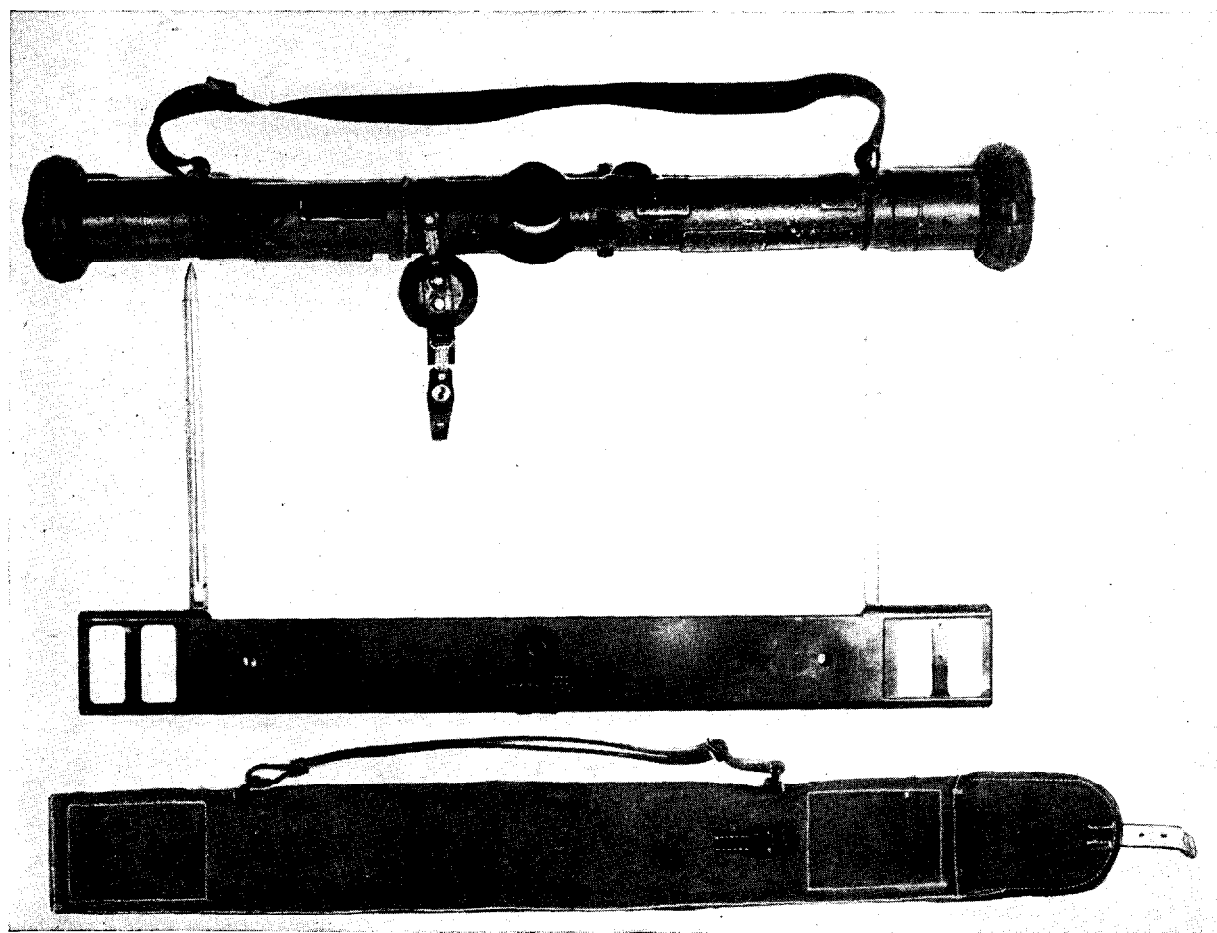


Figure 18.—70 cm Range Finder with adjusting lath and carrying case.

structed in three major parts: the periscope, the telescope, and the angle-of-site mechanism. When assembled, these can be mounted on the spindle of a tripod. The instrument can be used to measure vertical and horizontal angles; by using the magnetic needle, magnetic bearings can be taken. When disassembled, part of the instrument can be used for plane table work.

(2) *Description.* The periscope is fitted to the aiming circle by means of a dovetailed slide. Its function is merely to raise the line of sight. It has no magnifying power. The telescope has an adjustable focussing eyepiece, with a leveling bubble on top. A lighting attachment is provided on the left side. To the left of the telescope is a spherical level by which the head can be leveled. The angle-of-sight mechanism can be rotated through a total of 1,400 mils, the horizontal being 300 mils. The smallest graduation is 1 mil. The traversing mechanism is graduated in mils

from zero to 6,400. A quick release mechanism is provided.

The tripod is adjustable in height and has a traversing mechanism. A spindle projecting from the traversing head forms the support for the aiming circle. Two rings in which the spindle is mounted eccentrically control its vertical position, and by rotating these rings the spherical level can be centered.

d. RANGE FINDERS. (1) *General.* In general, German range finders are of the stereoscopic type, but a 70-cm base coincidence range finder, though no longer in production, is still in use. Range finders are known to exist in the following sizes:

- 70-cm base.
- 1-meter base.
- 1.5-meter base.
- 4-meter base.
- 6-meter base.
- 10-meter base.
- 12-meter base.

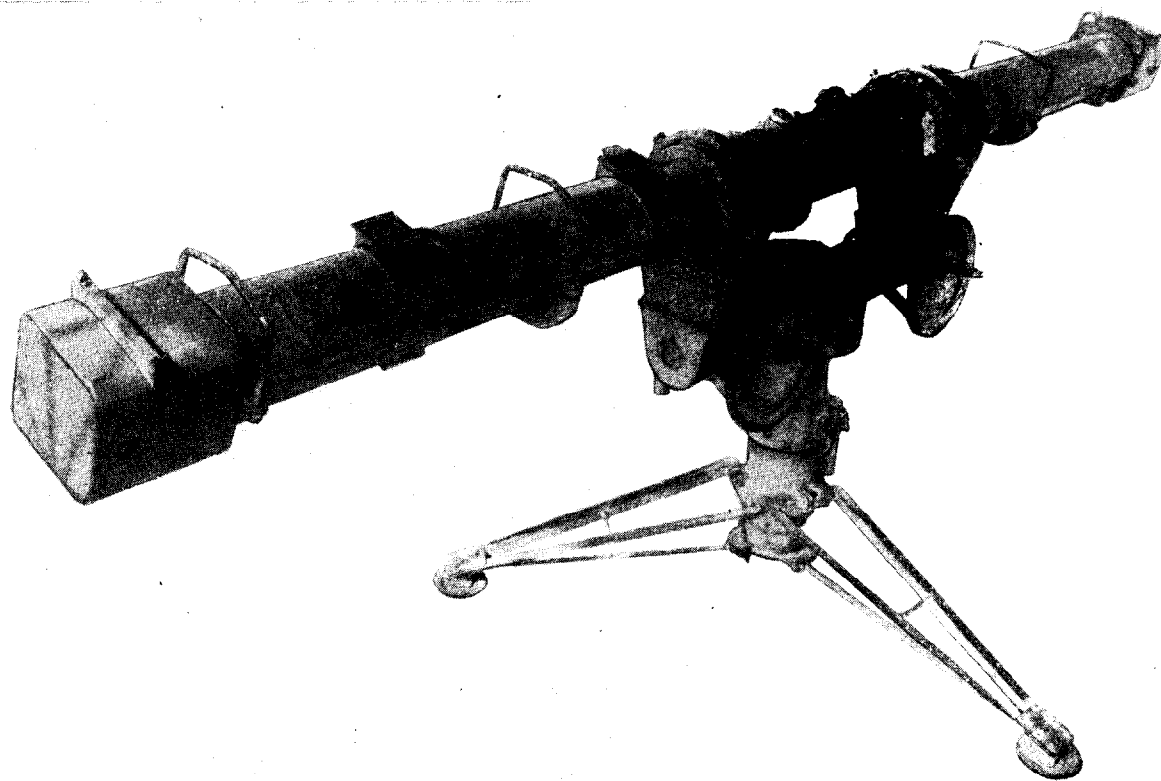


Figure 19.—4-meter Range Finder, Model Em 4m R40.

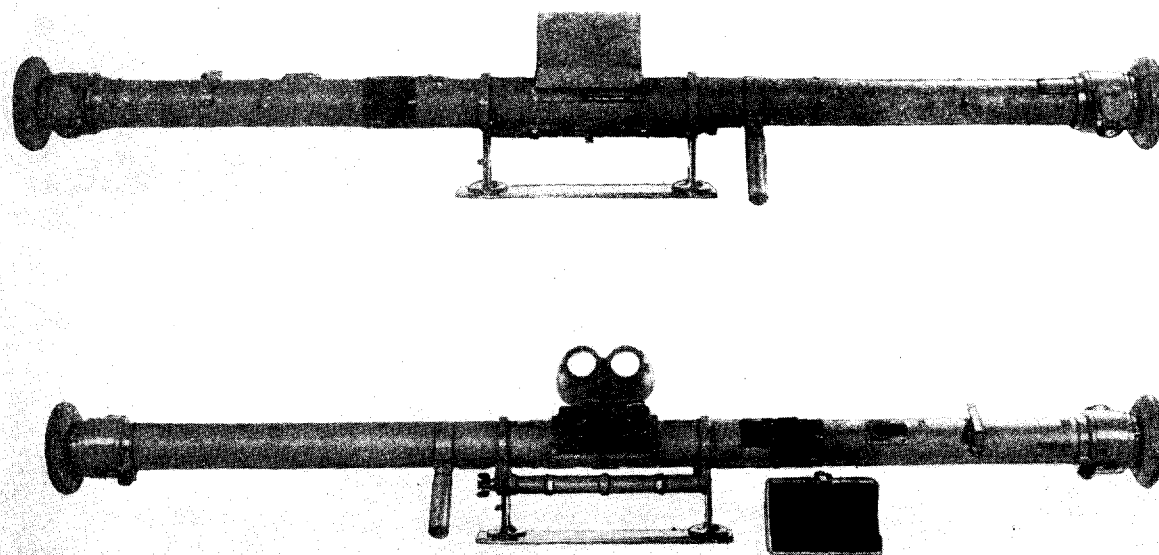


Figure 20.—Range Finder, 1.5 meter-Base. (Top) Assembled view. (Bottom) Assembled ready for use.

(2) *70-cm Range Finders 14 and 34* (*Entfernungsmesser 14 and 34*).

(a) *General*. The 70-cm (27.56 inches) coincidence range finder is used by German machine-gun and mortar units, and by airborne troops for obtaining the ranges of ground targets. It also is used with the *M.G.34* for antiaircraft fire. For adjustment an artificial infinity is used. There is no adapter for mounting on a tripod.

(b) *Characteristics*.

Base length70 cm (27.56 inches).
Magnification11 x.
Range219 to 10,930 yards.
Weight of Range finder...10 pounds.
Weight of case complete...4.5 pounds.

(3) *1-Meter (39.37 inches) Stereoscopic Range Finders*. (a) *General*. These portable 1-meter base range finders are used largely by light anti-aircraft units manning 20-mm and 37-mm guns.

(b) *Characteristics*.

	<i>Em.R. 1 m.</i>	<i>Em.R.36 1 m.</i>
Base length	....39.37 inches	....39.37 inches.
Magnification	..7.8 x	.....6 x.
Range	.....275 to 8,740 yards.	545 to 10,930 yards.
Weight	.....9.9 pounds	.....16 pounds.

(4) *1.5-Meter (59.06 inches) Stereoscopic Range Finder (Em.R.1.5 m)*. (a) *General*. This range finder is provided with a tripod and is only used against fixed targets.

(b) *Characteristics*.

Base length59.06 inches.
Magnification11 x.
Range435 to 21,860 yards.
Weight20.9 pounds.
Weight of tripod.....39.6 pounds.

(5) *4-Meter (157.48 inches) Range Finder (Em.R. 4 m)*. (a) *General*. This is the standard instrument for use with heavy anti-aircraft guns. It may be employed either as an independent range finder, or incorporated into an anti-aircraft director. As a range finder it is served by a crew of four: rangetaker, layer for line, layer for elevation, and reader.

(b) *Characteristics*.

Rangefrom 2,200 feet.
Weight420 pounds.

(6) *6-, 10-, and 12-Meter Range Finders*. These instruments are used for range measurement for seacoast artillery.

Section IV. SIGNAL EQUIPMENT

1. Constructional Features

a. *GENERAL*. Two features stand out in the construction of Germany Army communications equipment: the unit construction methods employed and the material from which the units are made.

b. *UNIT CONSTRUCTION METHODS*. Practically every piece of radio equipment is constructed in units, which are secured to panels and to each other, electrical connections being made by plug and socket strips or by screwing tags or soldering wires to a terminal strip. In most cases this permits quick dismantling for servicing and repair.

c. *MATERIALS USED* (1) *General*. The metal from which radio sets are made is almost universally an alloy of about 90 per cent magnesium; 8 per cent aluminum; and 2 per cent zinc, copper, and other metals. Each unit consists of a die-casting of this alloy. Not only is the main sub-chassis cast, but also the screening plates, bosses, and recesses for mounting components. The castings are accurately made, requiring little machining, thus establishing excellent mechanical rigidity and improved electrical performance.

(2) *Tuning condensers*. Main tuning condensers are made from the standard alloy. Both rotors and stators are machined from a block casting. Thus, there can be no deterioration in performance due to corrosion between individual plates and their mountings.

(3) *Insulation*. Extensive use is made of ceramic materials for insulating; they are used for tag strips, tube holders, tube bases, coil formers, and almost universally as the main bearing for ganged condensers. Where coil formers are not made from ceramics, porcelain or pressed bakelised paper is used.

(4) *Condensers*. Trimmer condensers are usually either small, air-spaced ones, or of the silvered ceramic-disc type (Philips), which are used to some extent in British and American equipment. Small, fixed condensers are the tubular ceramic type or flat mica type in a bakelite shroud. Except in older versions of the 100 W.S., mica is used sparingly. Larger condensers are paper-dielectric Mansbridge type. No color coding is used, the values being printed on the condenser in mF, pF, or centimeters.

(5) *Resistors*. Resistors are usually of the noninductive carbon type, although a few wire-wound ones are employed purely for direct current purposes, such as voltage dividers. No color coding is used, the values being printed on the resistor in ohms.

(6) *Coils*. Low frequency coils and chokes are wound with single-strand, enamel-insulated wire, or with silk-covered *listendraht* wire. High frequency coils usually are wound with bare copper or copper strip. Alternatively, the coil former has a helical groove in which a thin layer of copper is deposited, apparently by electrolysis. The inductance of most high frequency coils can be varied within small limits by adjustment of a co-axial iron dust core, or copper ring. Intermediate frequency transformers not only have iron dust cores, but are in many cases completely enclosed in an iron dust shrouding.

(7) *Tubes*. German radio receivers of modern design have only one type of tube throughout, usually a pentode. These tubes are not always used in an orthodox fashion—for instance a pentode may be used as a diode—but the method considerably facilitates the supply of spares.

2. Power Supplies

Power supplies vary according to the purpose for which the piece of equipment is used. Vehicle sets employ separate rotary converters driven from the 12-volt vehicle storage batteries. These converters are of heavy rugged construction, and therefore remain serviceable for long periods without attention. Ground stations employ storage batteries and dry batteries, pedal operated generators, or small gasoline electric sets. Pack sets employ storage batteries with dry batteries or synchronous vibrators.

3. Simplification

a. *CONDENSERS*. Great pains are taken to make the working of the sets as simple and reliable as possible. Tuning condensers are driven through a chain of precision gearing, using fiber and spring-loaded metallic wheels to remove backlash.

b. *DIALS*. The dials are of a large size, with calibration spaced over 300 degrees or more. They are accurately marked out, permitting the frequency to be set to very close limits without the use of a wavemeter. Most dials are marked with one or more check points, allowing initial calibration to be accurately set or checked by means of an external or internal crystal oscillation or by means of an internal "glow crystal" (*leuchtquarz*).

c. *NUMBERING*. As an aid to both construction and servicing, each component in a set has a number, and in many cases the wiring is numbered also. Any two points bearing the same number are directly connected.

4. Armored Vehicle Radio Sets

a. *GENERAL*. Complete sets in armored vehicles include transmitter, receiver, power units, and accessories, referred to by the designation *Fu.*, followed by a number. An exception is the voice transmitting set *Fu. Spr.f.* used in self-propelled field and medium artillery vehicles and certain armored cars. This set has no *Fu.* number. Transmitters and receivers individually are referred to by a description and a letter, such as 10 watt transmitter "c".

b. *RADIO SETS USED*. The following tabulation shows what complete radio sets are likely to be installed in various types of armored and self-propelled artillery vehicles. Details on these sets will be found in the accompanying tables.

<i>Vehicle</i>	<i>Radio</i>
Commander's tank	<i>Fu.8</i> and <i>Fu.5</i> ; or <i>Fu.7</i> and <i>Fu.5</i> .
Fighting tanks, all types...	<i>Fu.5</i> and <i>Fu.2</i> ; or <i>Fu.5</i> only.
Assault guns	<i>Fu.5</i> and <i>Fu.2</i> ; or <i>Fu.5</i> (in armored formations) only.
Armored OP vehicles....	<i>Fu.8</i> and <i>Fu.4</i> ; or <i>Fu.8</i> , <i>Fu.4</i> , and <i>Fu.Spr.f.</i>
Assault guns (artillery)...	<i>Fu.8</i> , <i>Fu.16</i> , and <i>Fu.15</i> ; or <i>Fu.16</i> and <i>Fu.15</i> ; or <i>Fu.16</i> only.
Self-propelled antitank guns	<i>Fu.8</i> and <i>Fu.5</i> ; or <i>Fu.5</i> (light and medium chassis) only.
Self-propelled antitank guns	<i>Fu.8</i> and <i>Fu.5</i> ; or <i>Fu.7</i> and <i>Fu.5</i> ; or <i>Fu.5</i> and <i>Fu.2</i> . (heavy chassis)
Antitank-assault guns ...	<i>Fu.8</i> and <i>Fu.5</i> ; or <i>Fu.5</i> only.
Lynx (reconnaissance)...	<i>Fu.12</i> and <i>Fu.Spr.f.</i> or <i>Fu.Spr.f.</i> only.
Antiaircraft tanks.....	<i>Fu.5</i> or <i>Fu.2</i> only. (<i>Flakpanzer</i>)
Self-propelled heavy infantry gun	<i>Fu.16</i> only.
Wasp and Bumble Bee...	<i>Fu.Spr.f.</i> only.
Armored cars (except....	<i>Fu.Spr.f.</i> only. eight-wheeled vehicle) and semi-tracked vehicles with armament.
Armored cars	<i>Fu.12</i> and <i>Fu.Spr.f.</i>
Eight-wheeled armored car	<i>Fu.12</i> and <i>Fu.Spr.f.</i> or <i>Fu.Spr.f.</i> only.



Figure 21.—Short Wave Receiver Kz.F.a.

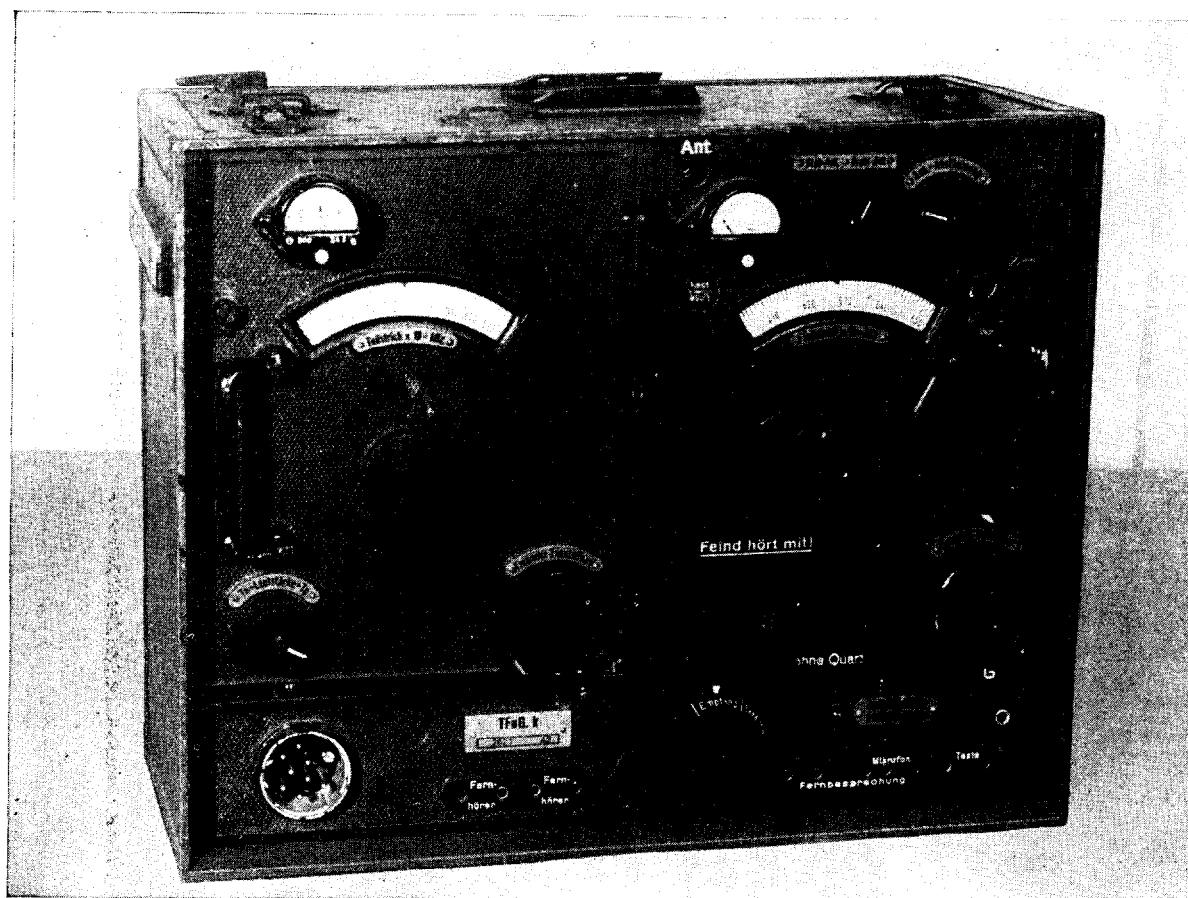


Figure 22.—Radio TFuG. k

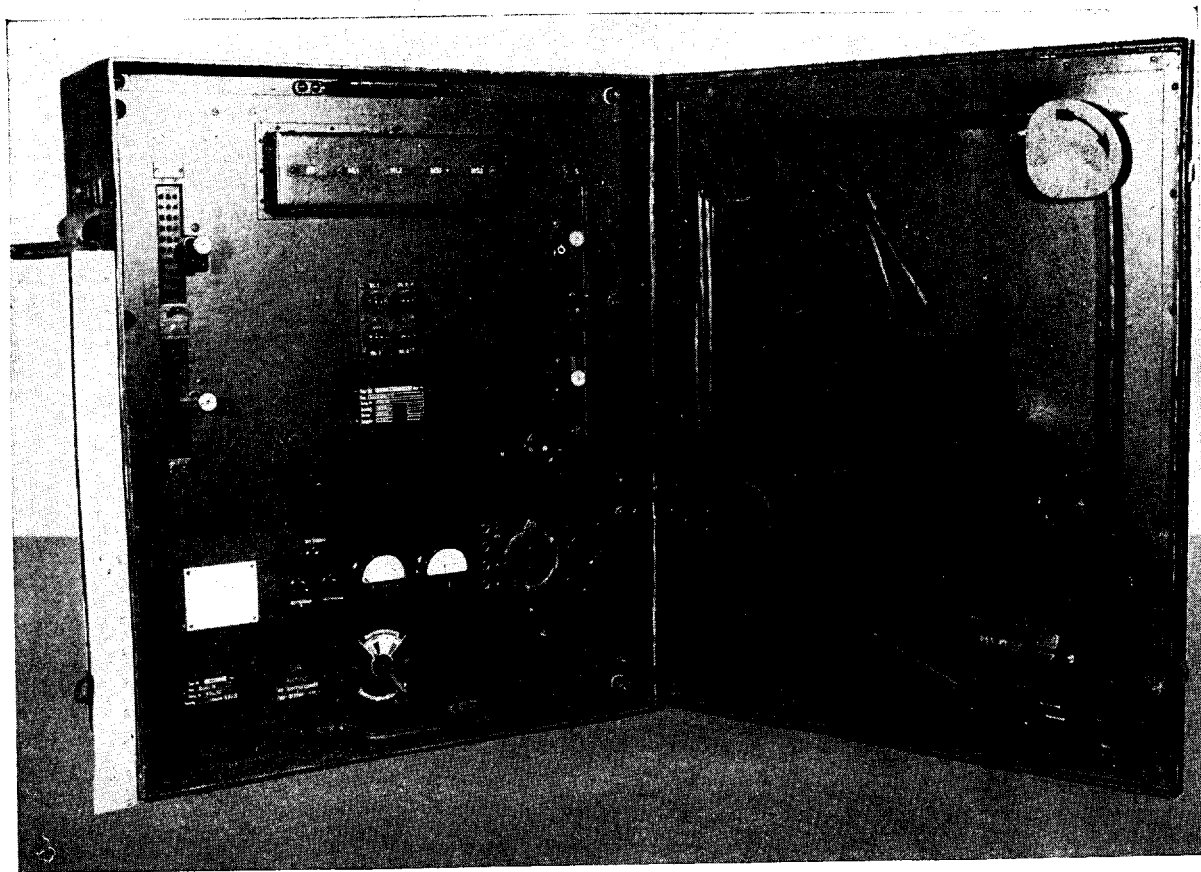


Figure 23.—Relaiskasten T39 Teletype Repeater.

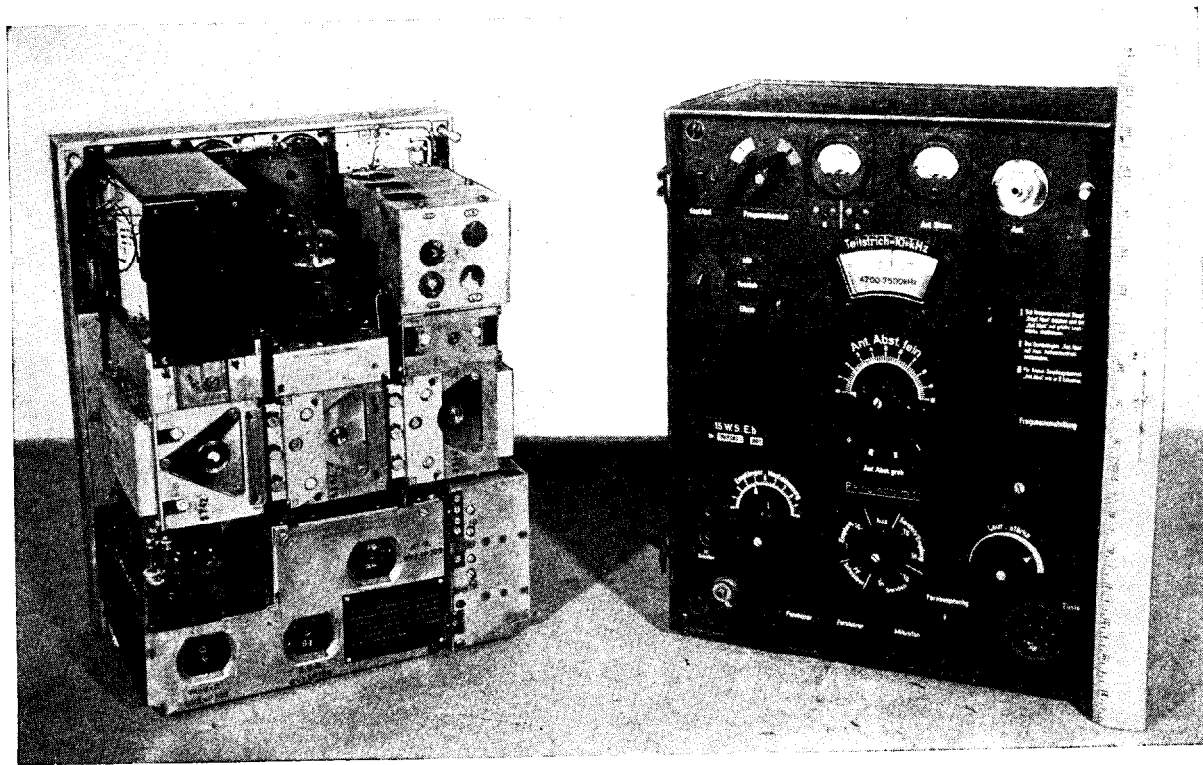


Figure 24.—Transmitter 15 W.S.E.b.

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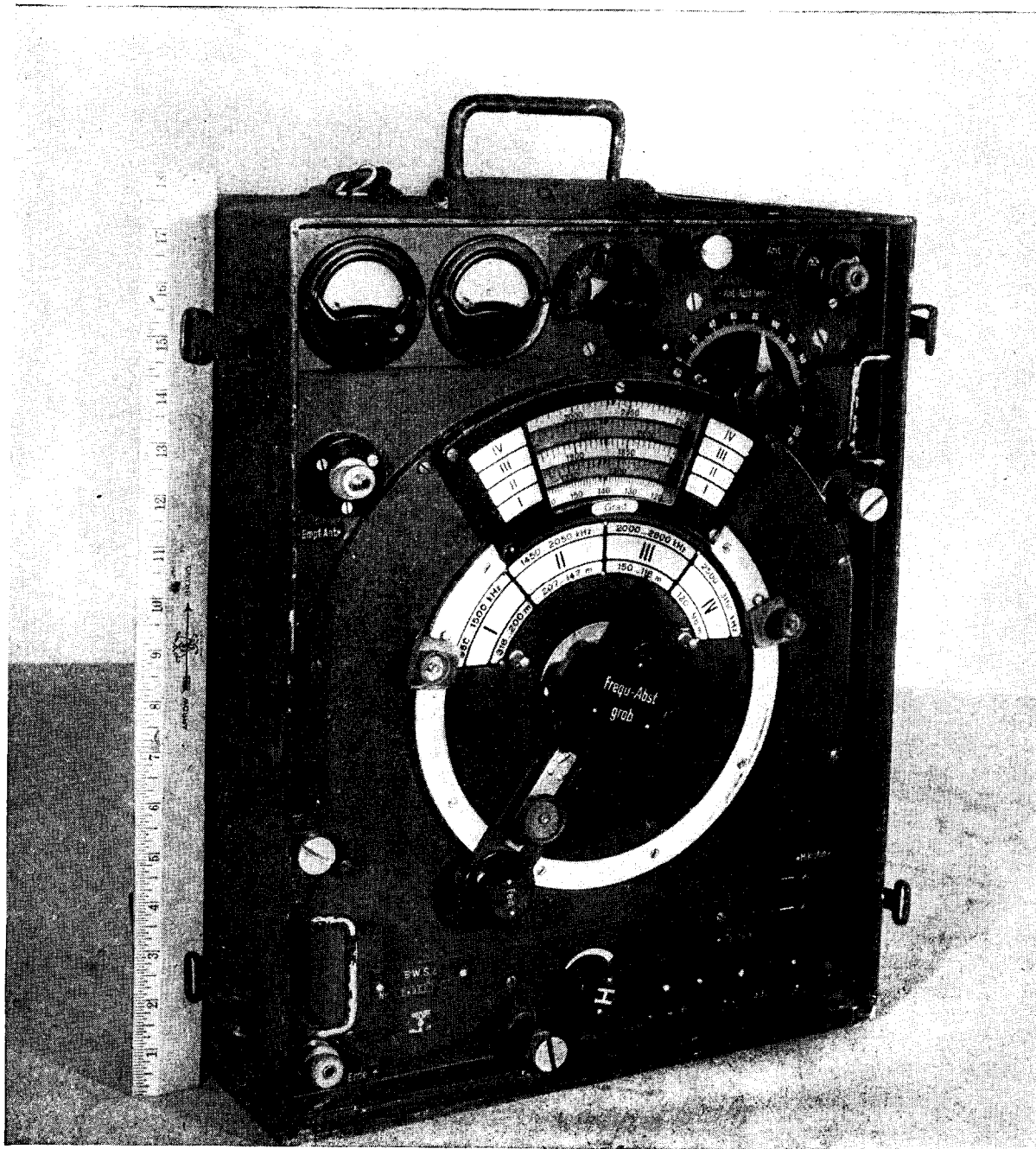


Figure 25.—Transmitter 5 W.S.A.

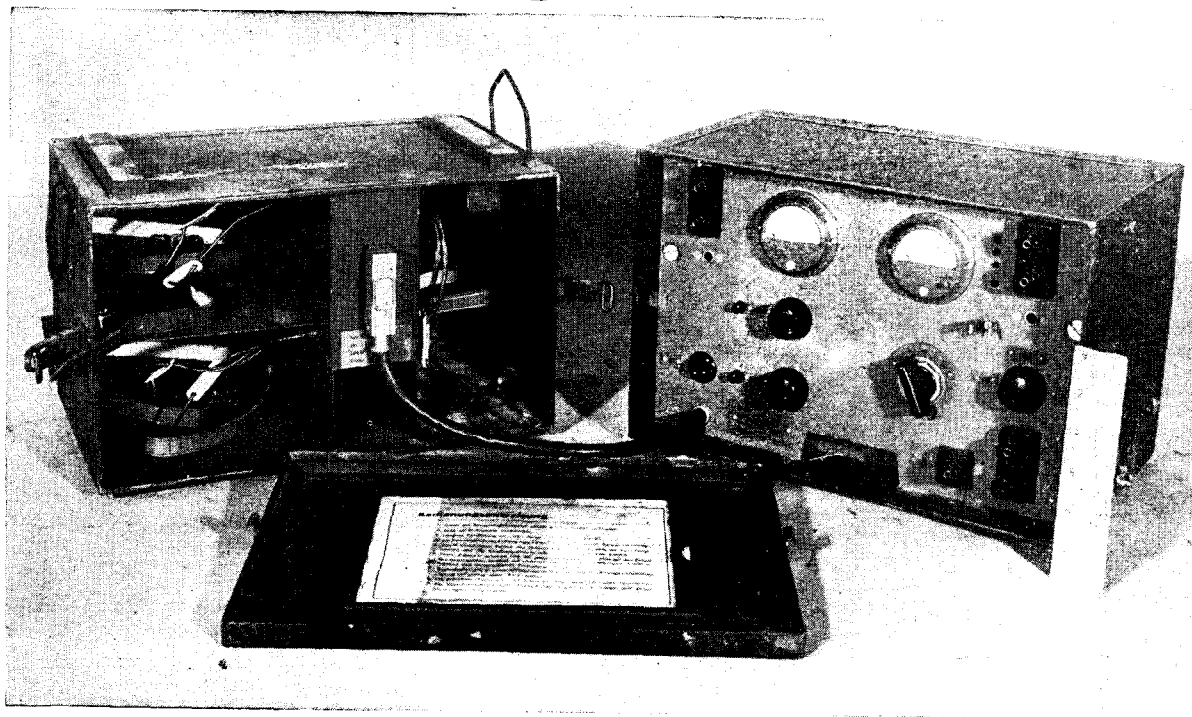


Figure 26.—Feldverstärker with battery case

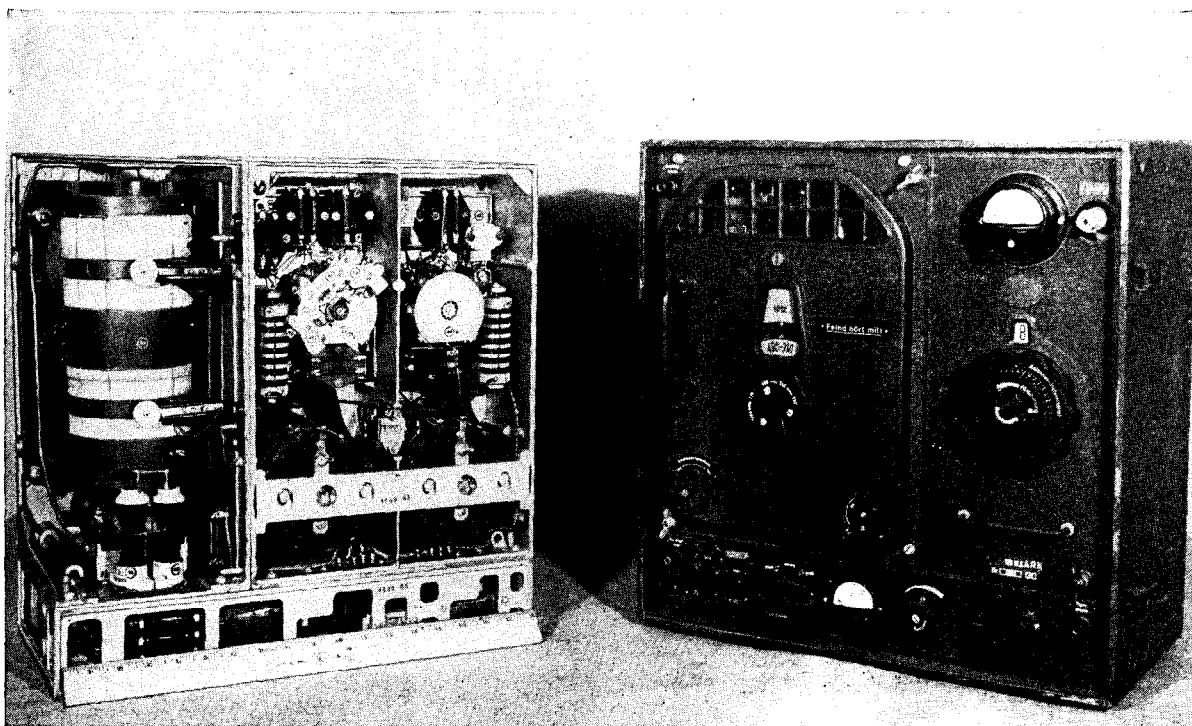


Figure 27.—Transmitter 100 W.

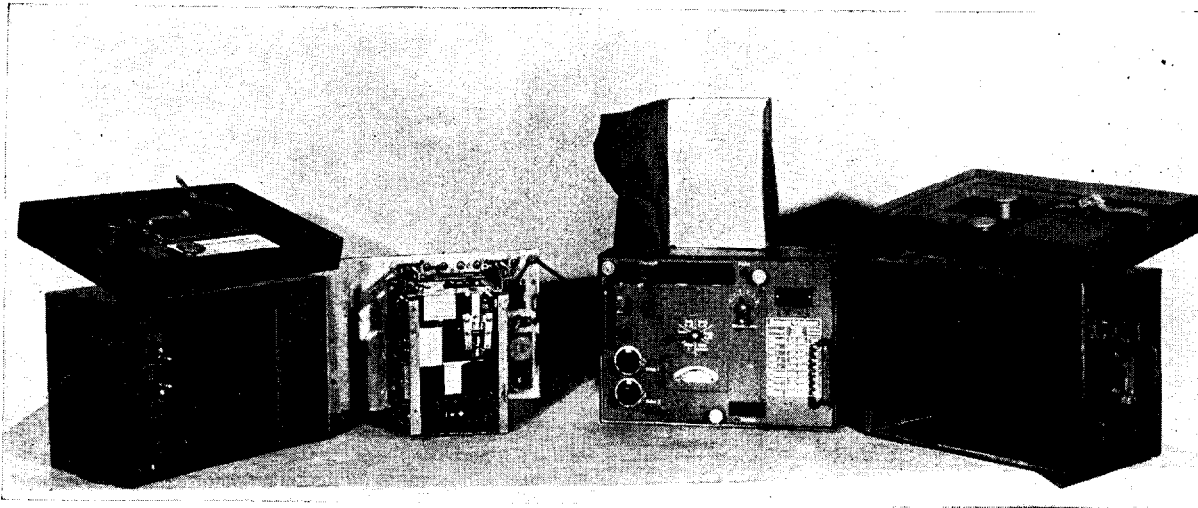


Figure 28.—Attenuator Meter Dampfrugmesser 39.

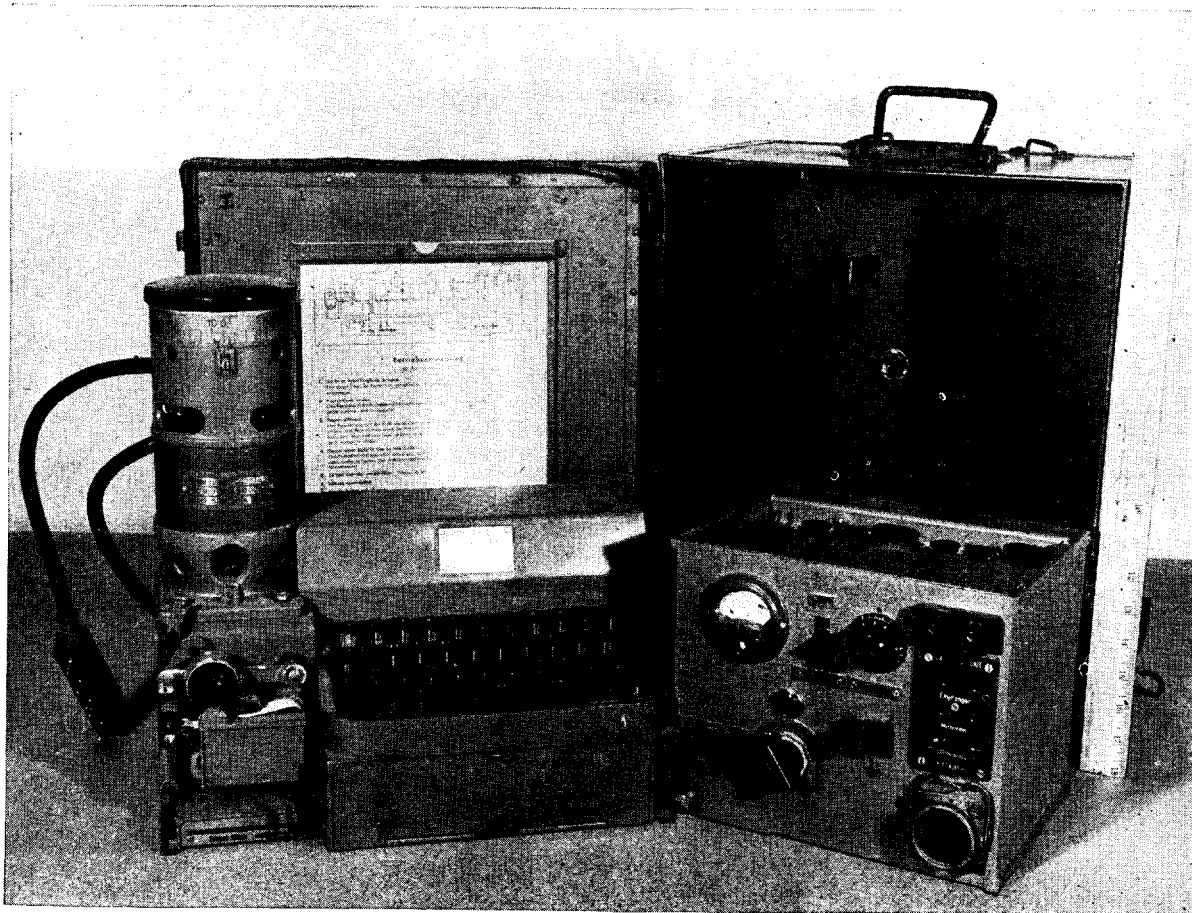


Figure 29.—Feldfernreiber.

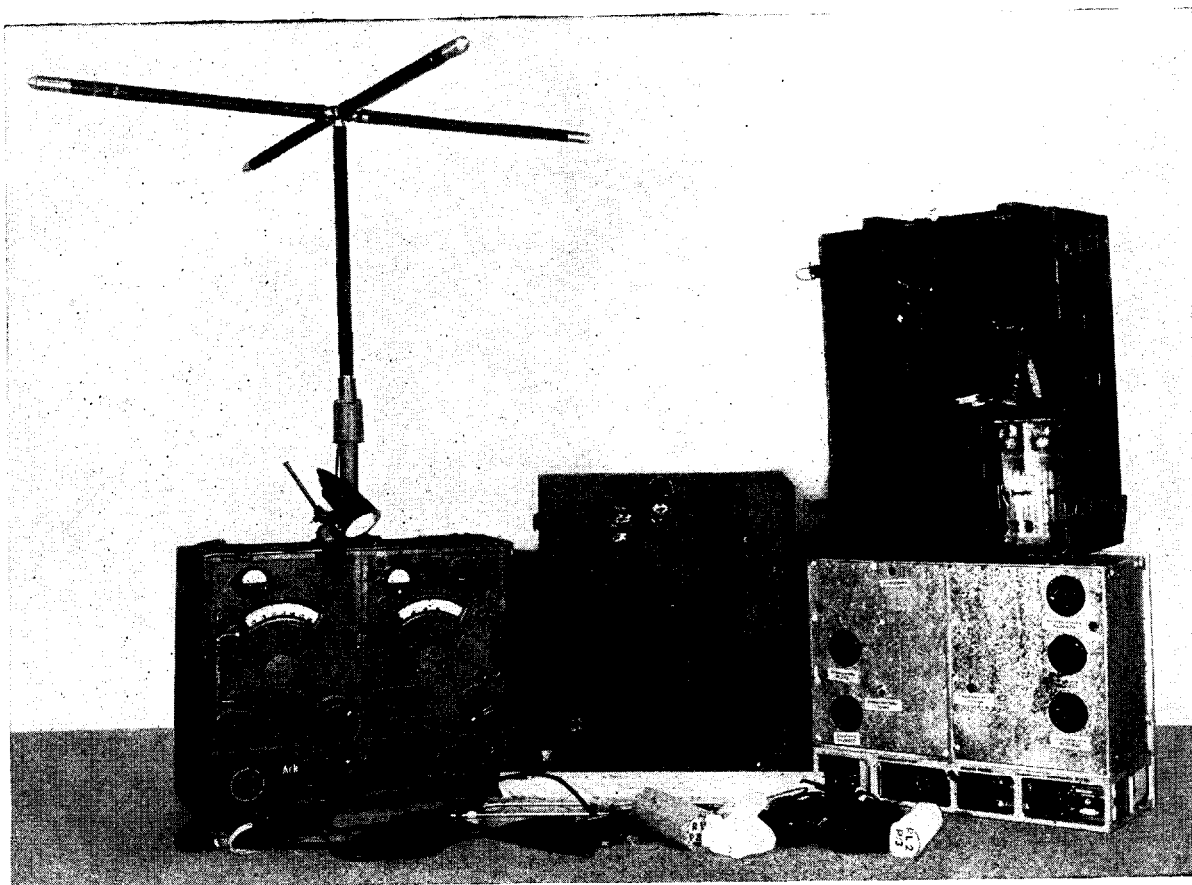


Figure 30.—Transmitter/Receiver (Torn.Fu. bl) with case for battery and accessories.

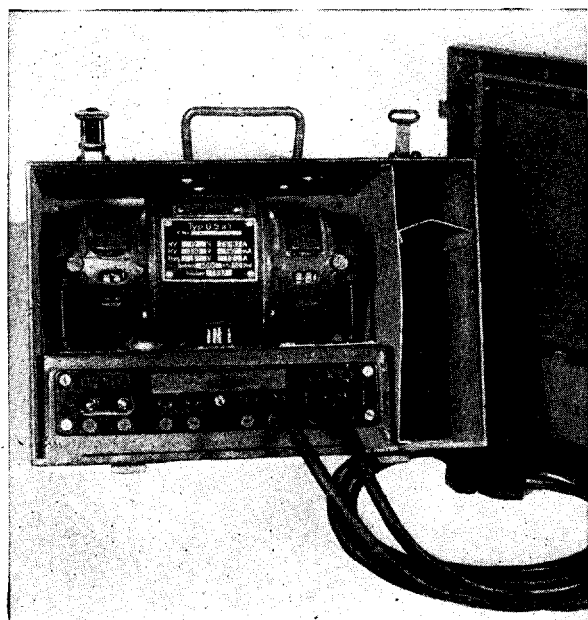


Figure 31.—Dynamotor U5a1.



Figure 32.—Fixed emplacement or wall telephone.

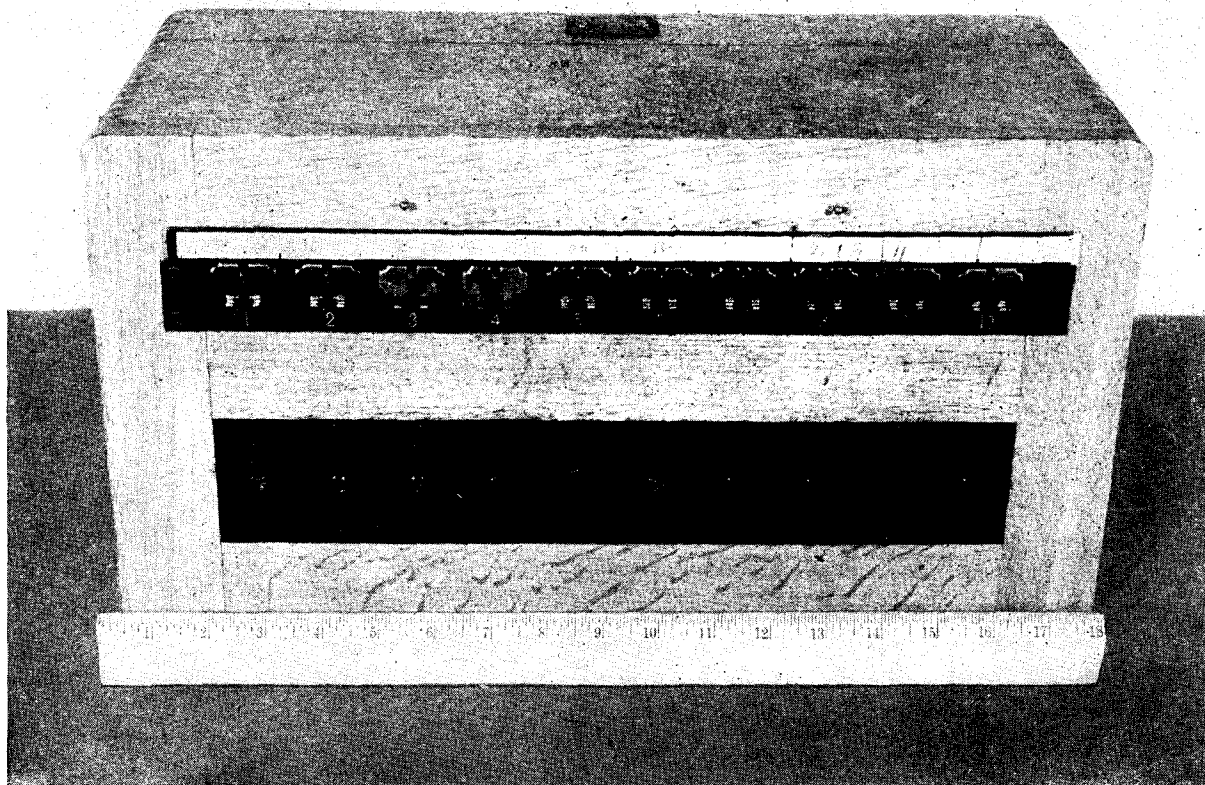


Figure 33.—10-Line switchboard.

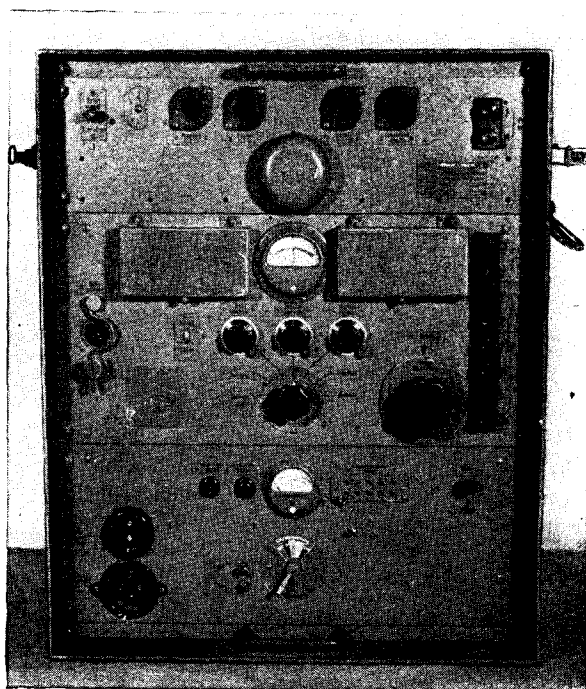


Figure 34.—Teleprinter terminal unit.

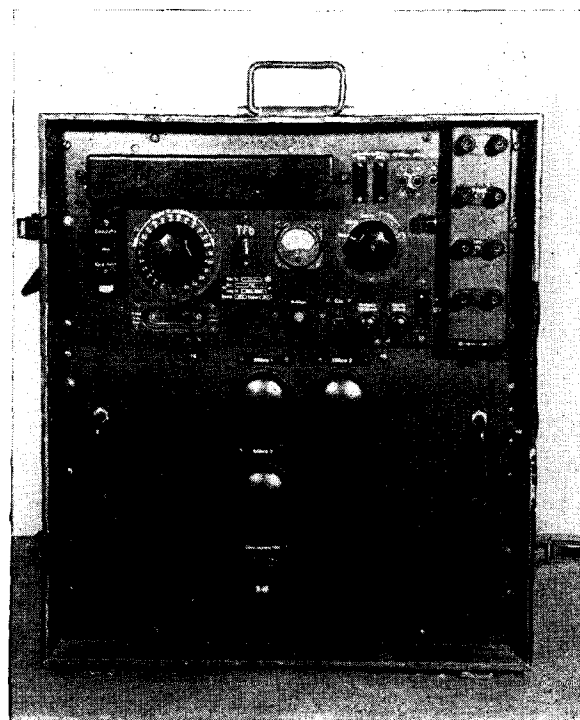


Figure 35.—Tfb 1 carrier frequency unit.

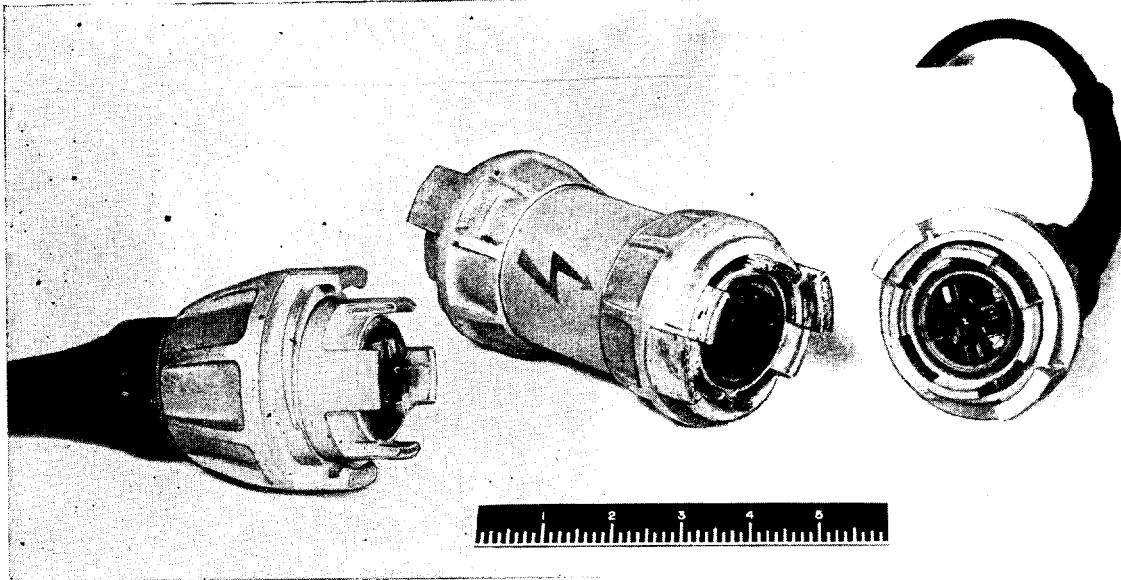
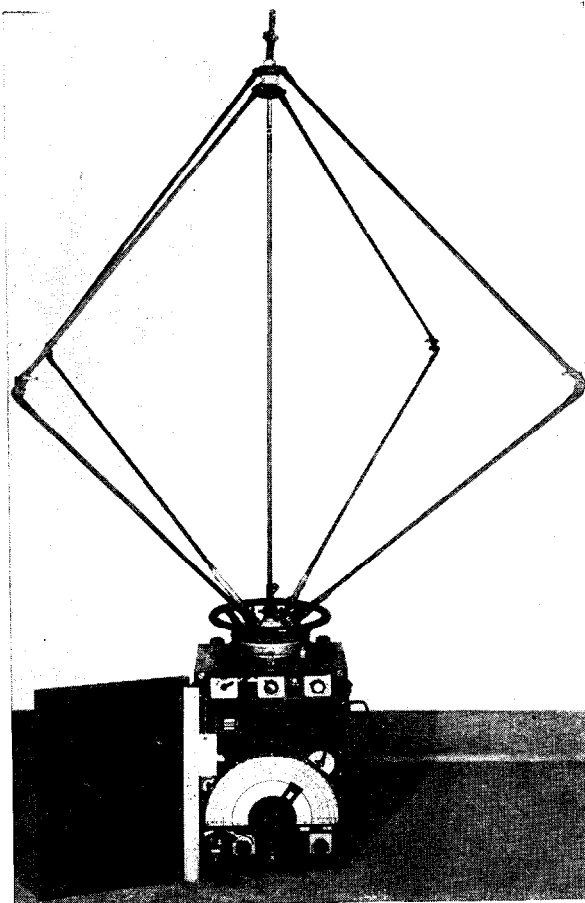


Figure 36.—"Spiral-Four" field telephone cable assembly.



Figure 37. Torn. 1 u. 2.

Figure 38.—Direction finder receiver E.P.2a.



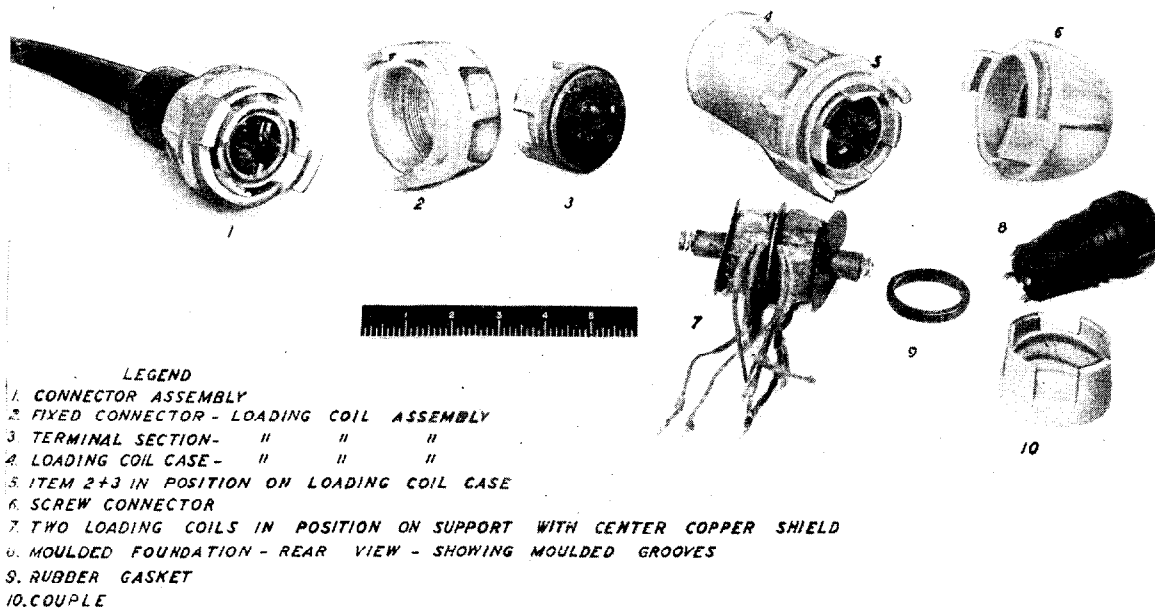


Figure 39.—"Spiral-Fow" field telephone cable unassembled.

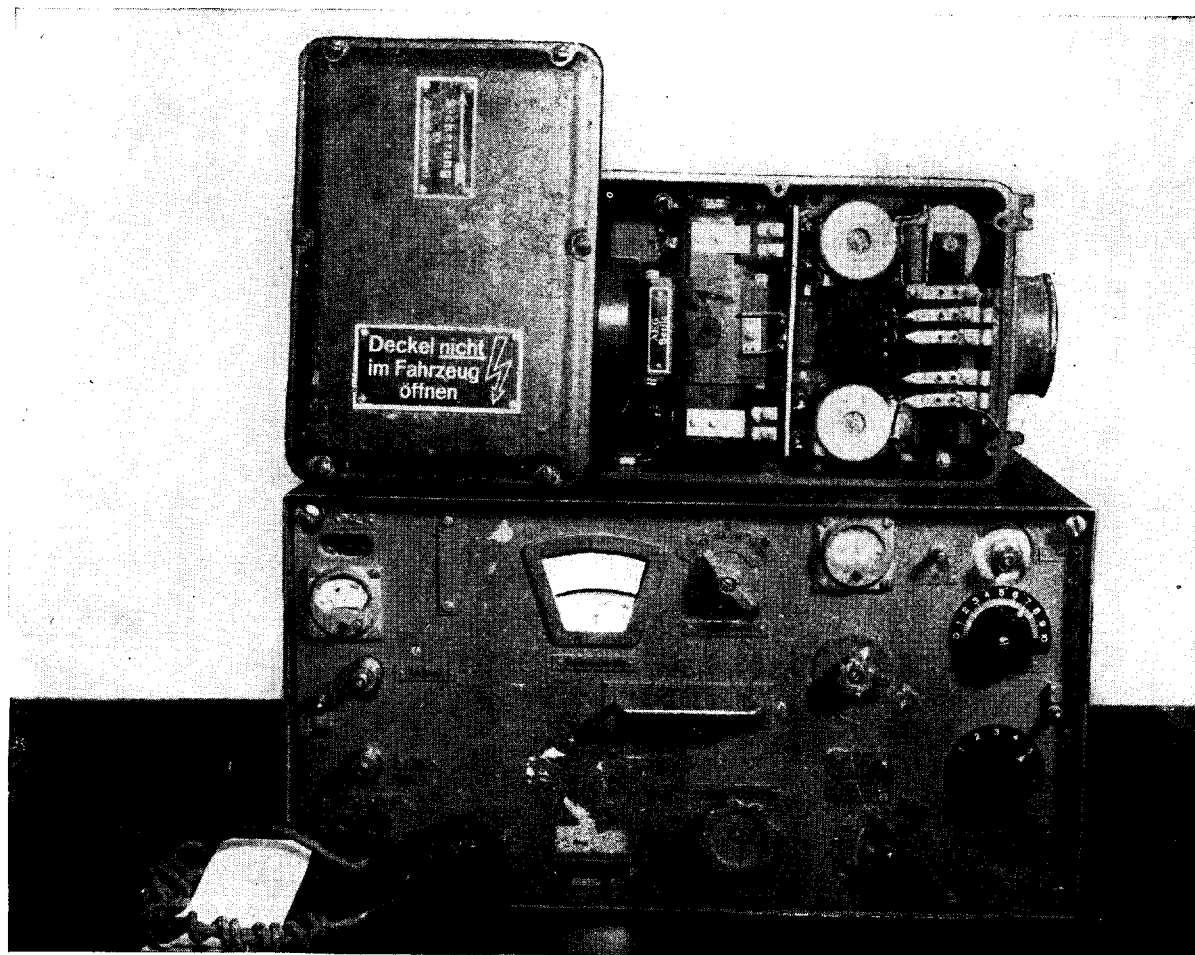


Figure 40.—301W. S. a.

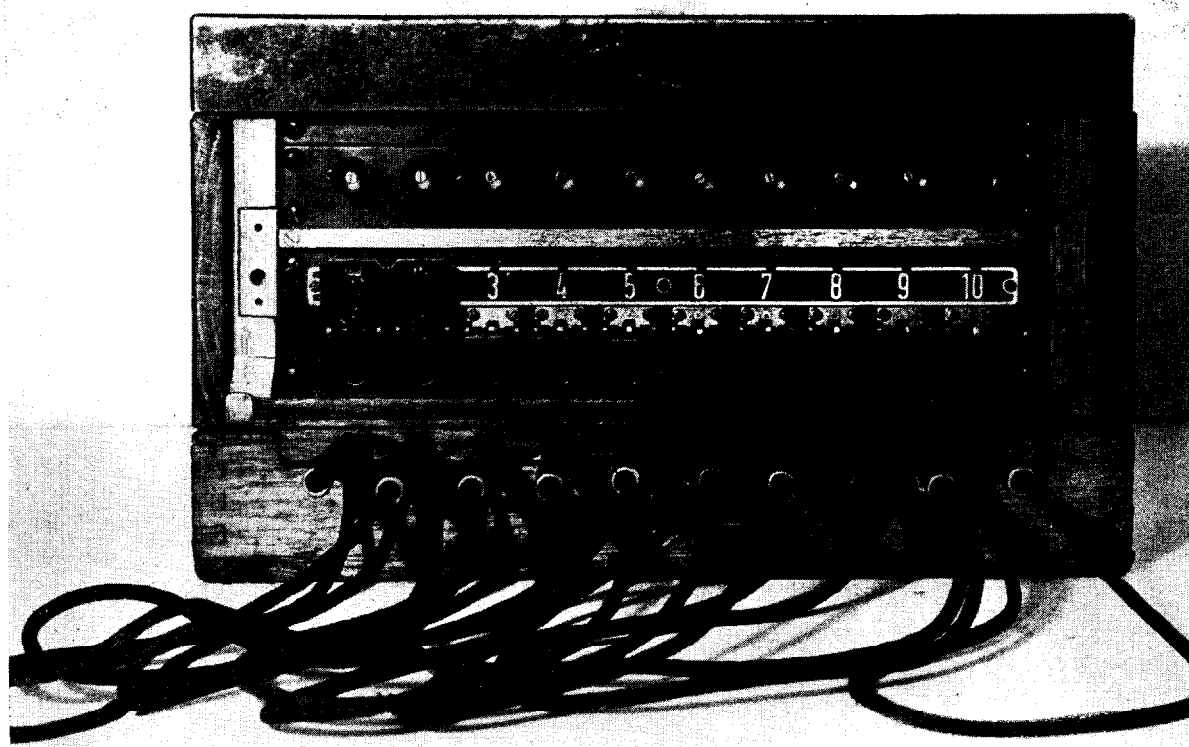


Figure 41.—Field telephone central (10 lines).



Figure 42.—Vibrator power supply E.W.E.



Figure 43.—Walkie Talker (Lindorf).

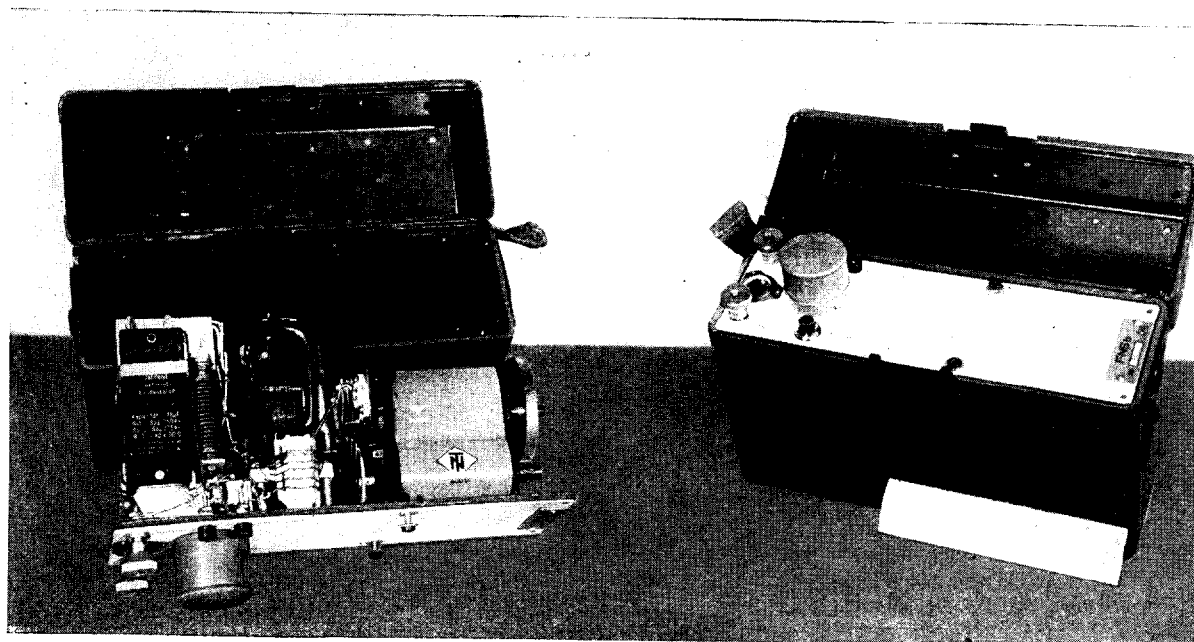


Figure 44.—Fortress emergency transmitter

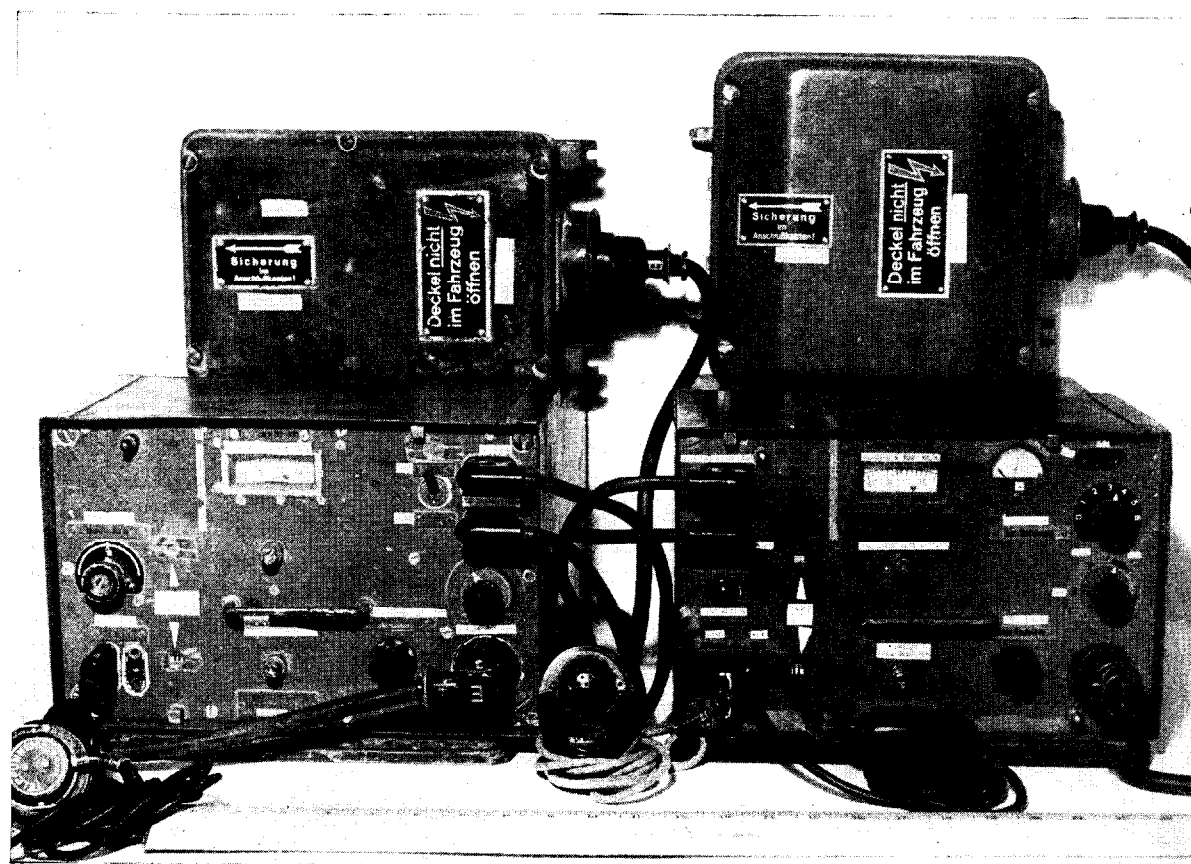


Figure 45.—Receiver Ukw. E.e. Transmitter 10 W's.c.

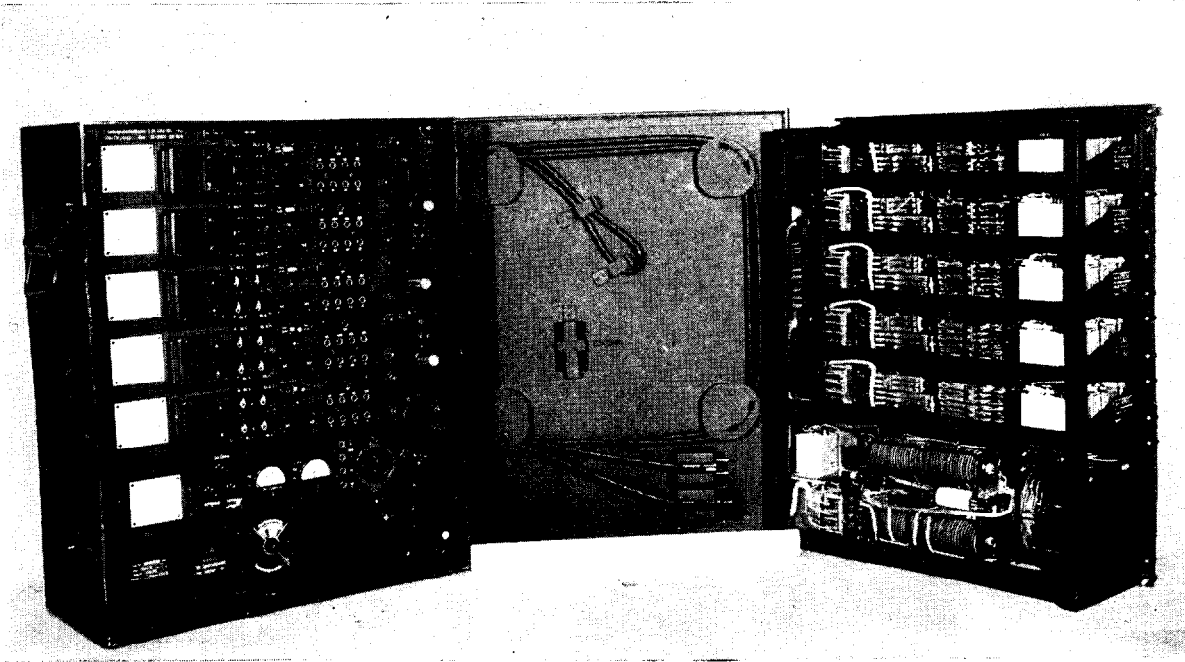


Figure 46.—Leitungsabschluss Kasten line terminal equipment.

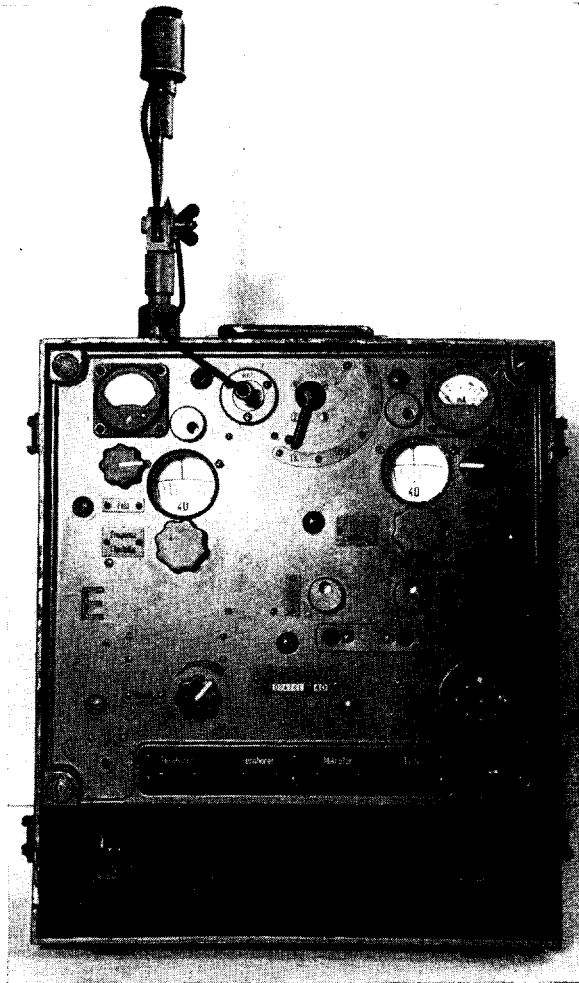


Figure 47.—Two-man pack Trans/Receiver (Torn. Fu. d2).

SPECIFICATIONS OF VACUUM TUBES USED IN GERMAN ARMY SIGNAL EQUIPMENT

NUMBER	TYPE	CATHODE TYPE AND RATING			USE AND APPLICATION	Plate Voltage *Maximum	Grid Voltage *Maximum	Screen Voltage *Maximum	Plate Current at Plate Voltage Indicated	Screen Current at Screen Voltage Indicated	Plate Resistance	Trans-conductance	Amplification Factor	Allowable Plate Dissipation	Allowable Screen Dissipation	Load Output	Maximum Grid-Plate Capacity
		C.T.	VOLTS	AMP.		VOLTS	VOLTS	VOLTS	M A	M A	OHMS	umhos	u	WATTS	WATTS	OHMS	uufds
AB2 Telefunken AB2 Valvo 4D1 Loewe	Duo-Diode Receiver Tube	Ind.	4 A.C.	0.65	H.F. Rectifier												
AC2 Telefunken AC2 Valvo AC2 Tungstam	Triode Receiver Tube	Ind.	4 A.C.	0.65	Audio and H.F. Tube Oscillator L.F. Amplifier	250*	-5.5		6		12,000	2,500	30	2.0			1.7
AF3 Telefunken AF3 Valvo AF3 Tungstam 4H2 Loewe	Variable mu Pentode Receiver Tube	Ind.	4 A.C.	0.65	Variable mu H.F. Tube	250* 250*	-3 -55	100 100	8 .015		1.2M 10M	1,800 2	2,200	2.0			0.003
AF7 Telefunken AF7 Valvo AF7 Tungstam 4H1 Loewe	Pentode Receiver Tube	Ind.	4 A.C.	0.65	H.F. Tube Audio Frequency Amplifier (Resistance Coupling) Audio Tube	300* 	-2 	100 	3 0.9		20M 	2,100 	4,000	1.0			0.003
AL4 Telefunken AL4 Valvo 4E1 Loewe	Pentode	Ind.	4 A.C.	1.75	Output Pentode	250	-6	250	36	5	50,000	9,500		9		7,000	
AZ1 Telefunken AZ1 Valvo TAZ1 Tungstam A21 Phillips VG5007 Huges	Duo-Diode Rectifier Tube		4	1	Full Wave Rectifier	Maximum A.C. Input 500 Volts per Plate— 300 Volts per Plate					—Maximum D.C. Output 60 M A 100 M A						
DAF11	Variable mu Pentode Diode		1.2 D.C.	0.05	Variable mu Pentode Low Frequency Amplifier H.F. Rectifier	150*	0	120	0.29		.9M			0.6			
DCH11	Triode Hexode		1.4 D.C.	0.075	Oscillator Convertor Variable mu												
DDD11	Duplex Triode		1.2 D.C.	0.1	Output Tube	120 150*	-4.5		6 per Plate							14,000	

Figure 48.

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SPECIFICATIONS OF VACUUM TUBES USED IN GERMAN ARMY SIGNAL EQUIPMENT—Continued

NUMBER	TYPE	CATHODE TYPE AND RATING			USE AND APPLICATION	Plate Voltage *Maximum	Grid Voltage *Maximum	Screen Voltage *Maximum	Plate Current at Plate Voltage Indicated	Screen Current at Screen Voltage Indicated	Plate Resistance	Trans-conductance	Amplification Factor	Allowable Plate Dissipation	Allowable Screen Dissipation	Load Output	Maximum Grid-Plate Capacity
		C.T.	VOLTS	AMP.		VOLTS	VOLTS	VOLTS	M A	M A	OHMS	umhos	u	WATTS	WATTS	OHMS	uufds
DF11	Variable mu Pentode		1.4 D.C.	0.025	H.F. Tube	150* 120	0 -3.5	120			1M 10M	700 7		105			
G407 Tungsram					Refer to RE074												
H406D Valvo RES094 Telefunken S406 Tungsram	Screen Tetrode Receiver Tube	Dir.	4 D.C.	0.062	H.F. Tube	200*	-2	80	4		4M	700	280				0.02
HL2/0.5 a					Ballast Tube												
LD 1	Triode				H.F. Tube												
LD 2	Triode (Transmitting)				H.F. Tube I.F. Stages												
LG 1	Diode				H.F. Tube												
LS50	Pentode (Transmitting)				H.F. Tube	2,100											
RE074 Telefunken G407 Tungsram H406 Valvo	Triode Receiver Tube	Dir.	4 D.C.	0.06	Audio and H.F. Tube Low Frequency Amplifier (Transformer Coupling)	150*	-9		3.5		11,000	900	10				4
RE084 Telefunken LD408 Tungsram A408 Valvo	Triode Receiver Tube	Dir.	4 D.C.	0.08	Audio Tube Low Frequency Amplifier	150*	-4		4		10,000	1,500	15				4.5
RE084K	Triode	Dir.	4	0.08	Audio Tube Low Frequency Amplifier (Transformer Coupling)	120					11,000	1,200	13.5				3
RE134 Telefunken L414 Tungsram L413 Valvo	Triode Output Tube	Dir.	4 D.C.	0.15	Output Triode	250	-17 12*		12			2,000		3		12,000	
REN904 Telefunken AG495 Tungsram A4110 Valvo LA203 Loewe	Triode Receiver Tube	Ind.	4 A.C.	1.0	Audio and H.F. Tube Low Frequency Amplifier	150*	-9		3.5		11,000	900	10	1.5			2

Figure 48 (Continued).

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SPECIFICATIONS OF VACUUM TUBES USED IN GERMAN ARMY SIGNAL EQUIPMENT—Continued

NUMBER	TYPE	CATHODE TYPE AND RATING			USE AND APPLICATION	Plate Voltage *Maximum	Grid Voltage *Maximum	Screen Voltage *Maximum	Plate Current at Plate Voltage Indicated	Screen Current at Screen Voltage Indicated	Plate Resistance	Trans-conductance	Amplification Factor	Allowable Plate Dissipation	Allowable Screen Dissipation	Load Output	Maximum Grid-Plate Capacity
		C.T.	VOLTS	AMP.		VOLTS	VOLTS	VOLTS	M A	M A	OHMS	umhos	u	WATTS	WATTS	OHMS	uufds
RENS1264 Telefunken AS4120 Tungstam H4111D Valvo	Screen Tetrode Receiver	Ind.	4 A.C.	1.0	Audio and H.F. Tube Low Frequency Amplifier (Resistance Coupling)	200*	-2	100	3		45M	2,000	900	1.0			0.006
RES094					Refer to H406D												
RES164 Telefunken PP416 Tungstam L416D Valvo LAP513 Loewe	Pentode	Dir.	4 D.C.	0.15	Output Tube	250	-11.5	80	12	1.9	60,000	14,000		3		10,000	
RGN2004 Telefunken PV4200 Tungstam G2004 Valvo VG3512 Huges 1561 Philips VG420 Sator	Duo-Diode	Dir.	4	2.0	Full Wave Rectifier	Maximum	um A.C.	input 300	Volts Per	Plate —	Maximum	m D.C.	Output	160 M.A.			
RL2P3 Telefunken	Pentode	Dir.	1.9 D.C.	0.28	H.F. Tube Oscillator	200*		150*			75,000	1,000	75	2.0			0.1
RL 2.4P2																	
RL2T2 Telefunken	Triode	Dir.	1.9	0.30		150*					5,000	2,400	12	2.0			2.85
RL 2.4T1																	
RL 12P10																	
RL 12T15																	
RL12P35 Telefunken	Pentode (Trans- mitting)		12.6														
RS 241V			3.8														
RS242																	
RS337 Telefunken	Pentode (Trans- mitting)		12														

Figure 48 (Continued).

SPECIFICATIONS OF VACUUM TUBES USED IN GERMAN ARMY SIGNAL EQUIPMENT—Continued

NUMBER	TYPE	CATHODE TYPE AND RATING			USE AND APPLICATION	Plate Voltage *Maximum	Grid Voltage *Maximum	Screen Voltage *Maximum	Plate Current at Plate Voltage Indicated	Screen Current at Screen Voltage Indicated	Plate Resistance	Trans-conductance	Amplification Factor	Allowable Plate Dissipation	Allowable Screen Dissipation	Load Output	Maximum Grid-Plate Capacity
		C.T.	VOLTS	AMP.		VOLTS	VOLTS	VOLTS	M A	M A	OHMS	umhos	u	WATTS	WATTS	OHMS	uufds
RV2P700 Telefunken	Pentode	Dir.	1.9	0.09	Audio and H.F. Tube Short Wave Tube	200*		120*			1.2M	900	850	1.0			0.01
RV2P800 Telefunken	Pentode	Dir.	1.9	0.18	Audio and H.F. Tube	200*		150*			1M	900	800	1.5			0.01
RV2.4P700																	
RV12P2000 Telefunken	Pentode	Ind.	12.6	0.065	Audio and H.F. Tube Short Wave "Universal" Receiving Output Pentode	220*		140*			1.5M	1,500	2,000	1.0			0.005
RV12P4000 Telefunken	Pentode	Ind.	12.6	0.2	Audio and H.F. Tube "Universal" Receiving	200*		125*			1.8M	2,300	4,000	1.5			0.004
STV280/80																	
STV150/40Z					Voltage Regulator												

Figure 48 (Continued).

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POWER SUPPLIES FOR GERMAN RADIO SETS

TYPE OF EQUIPMENT	EXACT NAME- PLATE NO. MENCLATURE	INPUT					OUTPUT						USED WITH (GERMAN SETS)
		From	Consumption			Revo- lutions per min- ute	High voltage			Low voltage			
			Volts	Amperes	Watts*		Volts	Amperes	Watts	Volts	Amperes (max)	Watts*	
Dynamotors	U. 1500	3-phase motor	380 γ — 220 Δ	17.3 30	9,100	2,900	3,000 1,000	0.8 0.8	2,400 800	27 440	37 2	1,000 80	1000 W. S. 1500 W. S.
	U. 100 or U. 100a	12-volt storage battery	12	33/40		3,000	1,000	0.24	240	12	7.3	87.6	100 W. S.
	U. 80a			35	420	2,600	800/-300	0.3/0.005	240				80 W. S. a
	U. 30			16.5	195	3,200	330	0.35	115	12	3.3	39.6	30 W. S./24b-120
	U. 30b			12	144	4,000	400	0.175	70				30 W. S. a
	U. 20a U. 20a2 U. 20a3			10	120	2,800	370	0.16	60	12	2.75	33	20 W. S. c 20 W. S. d
	U. 20a1S												20 W. S. b
	U. 15a			14.6	175	5,500	320	0.19	60	4.8	2.6	12.5	15 W. S. E. a 15 W. S. E. b
	U. 10 and U. 10a1			6.7	80	3,500	350	0.115	40				10 W. S. c 10 W. S. h
	U. 5a1			7.5	90	4,000	330	0.140	46	5	1.2	6	5 W. S./24b-104
	E. U. a1, a2, a3			2.3	25	4,000	130	0.026	3.4	12			U. Kw. E. d. U. Kw. E. e
	S. E. U. a			5.2	62	8,000	300	0.070	21	12			Radiotelephone sets a. d. f
	Vibrator units (Consumption fig- ures include re- ceiver, low-volt- age)	E W b	2-volt storage battery	2	1.5	3	100	0.010 0.014 0.024 0.010	1	2 2.4 2.4	0.75	1.5	Torn. E. b
E W c		12-volt storage battery	12	1	12				1.5 2.0		3.0 4.0	15 W. S. E. (Receiver only)	
E W d				2.5	30								
E W e				1	12								
E W f		2.4-volt storage battery	2.4										

Footnotes at end of table.

Figure 49.

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POWER SUPPLIES FOR GERMAN RADIO SETS—Continued

1 MARCH 1945

TYPE OF EQUIPMENT	EXACT NAME- PLATE NO- MENCLATURE	INPUT					OUTPUT						USED WITH (GERMAN SETS)
		From	Consumption			Revo- lutions per min- ute	High voltage			Low voltage			
			Volts	Amperes	Watts*		Volts	Amperes	Watts	Volts	Amperes (max)	Watts*	
Pedal generators	T 5 †	Foot driven				65	330	0.140	46	5	1.2	6	5 W. S./24b-104.
	T 15 †											SE469A	
	T 20 †					70							20 W. S. c 20 W. S. d
Engine generator sets (H. G. N. 100)	Heavy engine gen- erator set a.	4-stroke gasoline en- gine, 4 cyl, 26 hp.	Gasoline/oil.			1,500	220 380 3-phase a-c	40 23	15 kva				1,500 and 1,000 watt transmitters and workshop machines.
	Light engine gen- erator set C100.	2-stroke gasoline en- gine, 1 cyl, 1.8 hp.	1-¾ pints per hour (oil/gasoline 1/25)			3,000	1,000 a-c		300	12.8		90	100 W. S.
	Light engine gen- erator set C30 (H. G. N. 20a1).						350	0.3	105	15	7	105	Special sound ranging equipment.
	Light engine gen- erator set C20 (H. G. N. 20a).												
	Engine generator set F (WG3000).	4-stroke gasoline en- gine, 2 cyl, 9 hp.	Gasoline/oil.			1,500	220 a-c	13.6	3,000				
	Engine generator set (WG570a).	2-stroke gasoline en- gine, 1 cyl, 1.8 hp.	1¾ pints per hour (oil/gasoline 1/25).			3,000		2.6	572				
	Charging set C (LG650).									15/50 65	15/10 10	650	Storage battery charging with charging board C.
Engine generator charging sets	Charging set D (LG3000).	2-stroke gasoline en- gine 1 cyl, 6.5 hp.	5¾ pints per hour (oil/gasoline) . .			2,000				65	46	3,000	Storage battery charging (storage battery charging vehicle (Kfz.42).
	Charging set E (LG800).	2-stroke gasoline en- gine, 1 cyl, 1.8 hp.	1¾ pints per hour (oil/gasoline 1/25)			3,000				15	53	800	Float charging of radio storage battery while set is working (with charging board C).
	Engine generator (GG400).	2-stroke gasoline en- gine, 1 cyl 0.9 hp.	1¾ pints per hour (oil/gasoline 1/25)			4,800				12 16	33.5 25	400	
	Engine generator (GG600).									12 15.5	25-50	600	

Footnotes at end of table.

Figure 49 (Continued)

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POWER SUPPLIES FOR GERMAN RADIO SETS—Continued

TYPE OF EQUIPMENT	EXACT NAME- PLATE NO- MENCLATURE	INPUT					OUTPUT						USED WITH (GERMAN SETS)
		From	Consumption			Revo- lutions per min- ute	High voltage			Low voltage			
			Volts	Amperes	Watts*		Volts	Amperes	Watts	Volts	Amperes (max)	Watts*	
Hand charging sets	HLSa	Hand driven				82				4	4	16	Charging 2- and 2.4-volt radio storage batteries
Charging rectifiers (with metal recti- fication)	T 506b†	A-c mains	110/125 155/220	10/9/7/5							10	560	Storage battery charging
	T 200†			3.6/3.2 2.6/1.8					12/24 36/48	3.5	200		
	T 48†			1/0.9/0.7/0.5						1	48		
Transmitter recti- fiers (with metal rectification)	T 1500†	3 phase a-c mains	220/380	22/12.7			440/1,000/ 3,000 d-c	2/0.5/0.9	4,100	24	36	864	1000 W. S. 1500 W. S.
	T/100†	A-c mains	110/125 155/220	8.8/7.8 6.3/4.4			1,000	0.3	300	12	7.5	90	100 W. S.
	T5/10/20/30†			3.2/2.8 2.3/1.6			330	0.3	100	5 12	1.2 1.5	6 18	5-, 10-, 20-, and 30-watt trans- mitters
Receiver rectifier	N A 6		110/150 220/240				100	0.045	4.5	2-2.4	2.5-8	4	Long- and short-wave receivers
Lead-acid storage batteries	12 B 150	Charged by engine generator charging sets or charging rectifiers	12	15	*150						15	*120	For vehicle or radio use
	12 B 105				*105							*180	
	12 B 100			10	*100					12	10	120	
	12 B 60			6	*60						6	*72	
	12 B 75			*75									
	4 B 25		4	3.5	*25					4	3.5	*14	Obsolete radio storage battery
	2 B 38			8	*38						8	*16	For pack wireless sets
	2 B 19		2	2	*19						2	2	*4	For modulated-light speech equip- ment

Footnotes at end of table.

Figure 49 (Continued)

POWER SUPPLIES FOR GERMAN RADIO SETS—Continued

TYPE OF EQUIPMENT	EXACT NAME- PLATE NO- MENCLATURE	INPUT					OUTPUT						USED WITH (GERMAN SETS)			
		From	Consumption			Revo- lutions per min- ute	High voltage			Low voltage						
			Volts	Amperes	Watts*		Volts	Amperes	Watts	Volts	Amperes (max)	Watts*				
Nickel-cadmium storage batteries.	4.8 NC 10	Charged by engine generator charging sets or charging rectifiers	4.8	3.5	*10					4.8	2.5	*12	For pack wireless sets, field tele- phony sets, RDF and inter- cept sets			
	4.8 NC 5			1.5	*5						1	*5				
	2.4 NC 58		2.4	12	*58									2.4	12	*30
	2.4 NC 28			6	*28										6	*15
	2.4 NC 20			2	*20										2	*5
B batteries	90-volt DIN/VDE 1600						90	0.021	2				Pack wireless sets and receivers			
	30-volt						30		0.5				Long and medium wave RDF sets			
Field cells	Wet cell EL 1.5 KZF 30									1.5	0.3	*0.5	Field telephones and switchboards			

For watts column, items marked with an asterisk () indicate ampere hours, and are for batteries only.

†Letter T designates German word "TRAGFAHIGKEIT," meaning *carrying capacity*.

Figure 49 (Continued)

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**PARTICULARS OF RADIO EQUIPMENT USED IN GERMAN
ARMORED VEHICLES, SELF-PROPELLED ARTILLERY
AND ARMORED HALF-TRACKED VEHICLES**

Equip- ment No.	Designation of sets	Frequency range (kilocycles)	Aerial	Range		Remarks
				Kilometers Key	(Miles) Voice	
Fu. 1	Pack receiver "b" (<i>Torn.E.b.</i>)	100-6970				Receiver only.
Fu. 2	Ultra short wave receiver "e" (<i>UKw.E.e</i>)	27200-33300				Receiver only.
Fu. 3	Ultra short wave receiver "dl" (<i>UKw.E.dl</i>)	42100-47800				Receiver only.
Fu. 4	Medium wave receiver "c" (<i>MW.E.c</i>)	835-3000				Receiver only.
Fu. 5	10 watt transmitter (<i>10 W.S.c.</i>) Ultra short wave receiver "e" (<i>UKw.E.e</i>)	27200-33300	2-Meter Rod (Stationary) (On the move)	6 (3.7) 4 (2.5)	4 (2.5) 2 (1.3)	This is the standard tank equipment.
Fu. 6	20 Watt transmitter (<i>20 W.S.c.</i>) Ultra short wave receiver "e" (<i>UKw.E.e</i>)	27200-33300	2-Meter Rod (Stationary) (On the move)	10 (6.2) 8 (5)	8 (5) 6 (3.7)	This equipment may sometimes be found in Commander's tanks instead of Fu. 5, where extra range is required. The 20-watt transmitter "c" is no longer issued.
Fu. 7	20 watt transmitter (<i>20 W.S.d.</i>) Ultra short wave receiver "dl" (<i>UKw.E.dl</i>)	 42100-47800	2-Meter Rod	50 (31)	50 (31)	This is standard ground-air cooperation equipment.
Fu. 8	30 watt transmitter "a" (<i>30 W.S.a</i>) Medium wave receiver "c" (<i>Mw.E.c</i>)	1120-3000 835-3000	Roof aerial (Stationary) (On the move)	50 (31) 40 (24.8)	15 (9.3) 10 (6.2)	With 8-meter winch mast and star aerial the range increased to approximately 93 miles (key), 31 miles (voice).
Fu. 11	100 watt transmitter (<i>100 W.S.</i>) Pack receiver "b" (<i>Torn.E.b</i>)	200-1200 100-6970	Roof aerial (Stationary) (On the move)	80 (49.6) 50 (31)	20 (12.4) 10 (6.2)	With 9-meter winch mast and umbrella aerial range can be increased to approximately 124 miles (key), 43 miles (voice).
Fu. 12	80 watt transmitter (<i>80 W.S.a</i>) Medium wave receiver "c" (<i>Mw.E.c</i>)	1120-3000 835-3000	Roof aerial (Stationary)	80 (49.6)	25 (15.5)	With 8-meter winch mast and star aerial range is approximately 124 miles (key), 43 miles (voice).
Fu. 13	20 watt transmitter (<i>20 W.S.c.</i>)	27200-33300	2-Meter Rod (Stationary) (On the move)	10 (6.2) 8 (5)	8 (5) 6 (3.7)	Fu. 13 is the same as Fu. 6. extra receiver "c". See remarks under Fu. 6.
Fu. 15	Ultra short wave receiver "h" (<i>UKw.E.h</i>)	23000-24950				Receiver only.
Fu. 16	10 watt transmitter "h" (<i>10 W.S.h</i>) Ultra short wave receiver "h" (<i>UKw.E.h</i>)	 23000-24950	2-Meter Rod	4 (2.5)	2 (1.3)	This equipment is similar to Fu. 5 with different frequency range.
Fu. 17	Pack set (transmitter/receiver) "h" (<i>Torn. Fu. h</i>)	23000-24950	Rod	6 (3.7)	2½ (1.5)	Voice only portable set, not fitted in the vehicle.
Fu. 19	15 watt transmitter/receiver "a" (<i>15 W.S.E.a</i>)	3000-7500	Roof aerial			Range given as 19 miles (key), 16 miles (voice), but these figures probably only hold good when using rod aerial fixed at top of high mast (7 meters) (stationary).
Fu. Spr. f.	Transmitter/receiver <i>Fusprech.</i> "f"	19997.5-21472.5	1.4 or 2 Meter Rod (Stationary) (On the move)	—	5 (3.1) 2 (1.3)	Voice only. Equipment includes loud speaker.

Figure 50.

DETAILED DESCRIPTION OF GERMAN ARMY LINE COMMUNICATION EQUIPMENT INCLUDING FIELD TELEPHONES AND SWITCHBOARDS

NOMEN- CLATURE	DIMENSIONS AND WEIGHT	DESCRIPTION	REMARKS
Field Telephone 33	8.5"x11"x4"—12 lbs	This general purpose telephone for local battery operation only, with magneto system for calling, is equipped with magneto system. Provision is made for extra plug in headphones and testing of line and bell circuits, and two jacks connected in parallel with line circuit for connection as exchange. It can be connected to a post office exchange by a special adaptor. The power supply is 1.5 volts; either inert or dry cells may be used.	The instrument case is a bakelite moulding approximately 0.2 inch thick. The lid has a self locking fastener which is pressed to open. The shoulder strap has a hook on it from which the telephone head set can be hung if required operation of the instrument is conventional.
The German Wall Telephone for Field Emplacements.	15"x7 1/4"x5 1/2"	A telephone of extremely sturdy construction and used apparently where moisture and vibration are excessive. These telephones are local battery operated, mounted on concrete walls, and interconnected through ducts. The telephone is of heavy waterproof construction and the handset is connected to the main assembly by a heavy rubber-covered waterproof cord. The receiver is covered with a rubber earpiece. Both the main assembly case and the handset frame cover plate is fastened by means of 4 bolts with triangular shaped heads recessed in each corner of the face. This case plate is attached to the body by chains to prevent its falling off when loosened.	The ringing generator of this set is the same type as that employed in the field telephone 33; may be employed by Allied troops in locations where its qualities are desirable.
Endverstärker (f. Feldfernsprecher 33) (Terminal Amplifier for Field Telephone 33)	9" x7 1/4"x4 1/4" A.C. Set 8 1/2"x6 1/2"x3 1/2" Battery Set	AC powered unit: This is an audio-frequency amplifier employing one triode tube, type RE 084. The receiver circuit of the field telephone 33 is opened and the incoming signal is fed to the grid of the amplifier. The amplified signal is returned to the earphone receiver. Power is supplied through a transformer, having high and low voltage windings for plate and filament supplies. The plate supply is rectified (half-wave) by rectifier GL ₁ and the filament supply by a full wave rectifier GL ₂ . Battery operated unit: The principle of operation is very nearly the same.	This piece of equipment is an audio-frequency amplifier to increase the range operation of field telephone 33. They may be either powered by AC or by batteries. These sets are employed in place of, or in conjunction with field repeaters. When using the AC set, the handset of the field telephone 33 is used, but with the battery set there is already one provided.
Line Intercept Receiver LE. 35.	17 1/2"x13 1/2"x11"—78 lbs.	Provision for tapping to several telephone or telegraph lines and monitoring any one required. No Contact need be made as a loop brought to within a foot of the line may be sufficient. The equipment can be used to pick up earth currents between two earthed lines. The amplifier consists of a three-stage resistance capacity coupled circuit using three pentodes, all RV2 P800's. The amplifier has a gain of 72 db. Three fillers are incorporated in the set: (a) Storsieb: a special filter for alternating the odd harmonics of 50 cycles where main interference reduces intelligibility. (b) A band-pass filter normally in circuit. (c) Additional filter sections which reduce the band filter to 400 c/s-2200 c/s.	A portable line intercept amplifier, complete with batteries; may be either manpack or vehicle.
10-Line Exchange	8"x14"x6"—20 lbs.	The exchange will take up to 10 single or double line circuits. In case of mixed circuits (double and single lines to exchange) where the double lines are numerically superior, the single wire circuits should be connected via a cordless transformer, or vice versa if single lines preponderate. Subscribers lines may be connected either direct to the terminals 1 a.b. to 10 a.b. on top of the exchange or through a connection rack; or via 30-way plug and line system to a line terminal unit.	The exchange is roughly comparable with the British 10-line U.C. switchboard, although it is smaller and more compact.

Figure 51.

DETAILED DESCRIPTION OF GERMAN ARMY LINE COMMUNICATION EQUIPMENT INCLUDING FIELD TELEPHONES AND SWITCHBOARDS—Continued

NOMEN- CLATURE	DIMENSIONS AND WEIGHT	DESCRIPTION	REMARKS
German 10 Line Cordless Exchange (Exact German Nomenclature unknown)	9½"x17½"x7½"—	This set was designed for common battery operation, the line terminals being marked negative and positive, but may be used for local battery operation. It accommodates 9 lines besides operator's phone and can handle only two conversations at one time. Provision for night alarm circuit has also been made. Toggle switches for cross connection of the subscribers are utilized in conjunction with line drops which are located about the keys. May be paralleled with similar type of exchange.	Is well made, easy to use and maintain, but has the disadvantage of being unable to accommodate more than two calls at one time, though ideal for conference calls.
Small telephone exchange Box (<i>Vermittlung- skästchen</i>)	4"x4"x1½"	One line switchboard unit with an attachable visual indicator used with other such units to serve from two to ten or more telephone subscribers.	The set is well built and sturdy. Its simplicity and portability are outstanding characteristics.
The small fortress switchboard OB 36 (<i>Kleine Festungs- vermittlung</i>)	48"x39"x8"—	The switchboard is extremely heavy and housed in a cast iron box; brackets are provided at the back of the box for fastening the switchboard on a wall. Can accommodate 30 lines and 12 interconnections are possible. Provision has been made for connecting ten of the 30 lines on the OB 36 to common battery trunks. (Lines 21 to 30 being fitted with a 4 mfd condenser).	Because of its weight and size obviously could only be used in fixed installations. Is very similar to the OB 37 with the exception of two principle differences in circuit.
Large Field Switch- board for 60 lines		This is made up of three types of standard sections combined in multiple until desired size is reached. Is designed for local battery operation with ground return or metallic circuit. By adding a commercial adapter, connections may be established with civil exchanges using C.B. or automatic dial system. Is made up of 4 sections: (1) assembly "A" including plug cord holders and conference jack panel, (2) answering jack panel unit (ten jacks), (3) conference call panel, (4) adapter for use with automatic dial exchange.	With the use of multiple jack field this board can be built up to 300 lines. Knowing this, whether the term 60-line switchboard is applicable as a separate piece of equipment is a matter for further consideration.

Figure 51 (Continued).

DETAILED DESCRIPTION OF GERMAN ARMY LINE COMMUNICATIONS EQUIPMENT INCLUDING SWITCHBOARDS AND KINDRED EQUIPMENT

NOMENCLATURE	DIMENSIONS AND WEIGHT	DESCRIPTION	REMARKS
10-300 Line Switchboard	Operating Unit $9\frac{1}{2}" \times 13" \times 21\frac{1}{2}"$ —52 lbs. 10 Line Unit $4\frac{1}{2}" \times 13" \times 7"$ —11 lbs. 50 Line Unit $15\frac{1}{2}" \times 13" \times 7"$ —37 lbs. 100 Line Unit $15\frac{1}{2}" \times 13" \times 7"$ —31 lbs. 150 Line Unit $15\frac{1}{2}" \times 13" \times 7"$ —27 lbs. Bunching Unit $2\frac{1}{2}" \times 13" \times 7"$ — 5 lbs. Dialing Unit $7" \times 13" \times 7"$ —12 lbs. Superimposing Unit $7\frac{1}{2}" \times 13" \times 7"$ —21 lbs.	<p>The apparatus consists of several units built up to form the whole exchange: the operating unit, 10-line answering unit, 50-line answering unit, 100-line multiple unit, 150-line multiple unit, 10-jack bunching unit, dialing unit, and superimposing unit.</p> <p>Line connections are made at the rear of each unit by a 30-way connector with a 30-pin plug at each end.</p> <p>The drop-flap indicators are automatically restored when the associated jack has a plug inserted. A night alarm is also provided.</p>	Very neat, light and compact. probably used in line of communication formations.
Teleprinter Terminal Unit Incorporating Single Channel V.F. Equipment. (<i>Spring Schreibanschlussgerat</i>)	$24" \times 21" \times 9\frac{1}{2}"$ —93 lbs.	The terminal unit and teleprinter are operated from 110-220 volts AC (total consumption 150 watts). Provides for single and double current working (simplex or duplex) and remote control operation. (VF working.) Intercommunication between teleprinter and similar equipment over a line or radio link.	Used in line of communication companies.
Teleprinter Terminal Unit Incorporating Single Channel V. F. Equipment. (<i>Spring Schreibanschlussgerat</i>)	$24" \times 21" \times 9\frac{1}{2}"$ —96 lbs.	This is for simple working only and operates on the same type of power supply as above.	Both types can be worked with American and British teleprinter with the inclusion of their respective T.T. Units. For line of communication purposes.
Telewriter Tbs/24a-32	$17\frac{1}{2}" \times 15\frac{1}{2}" \times 9\frac{1}{2}"$ —57 lbs.	Sends figures 1 to 9 and 0, the characters +, -, /, ?, and the 26 letters of the alphabet. Works directly into a telephone line. Field telephone can be plugged in for speech working. A 900-cycles filter can be switched in to reduce interference. When the interference is too great, 900/c/s morse code can be sent and received on headphones. 12-pt socket on panel is for connection to radio set through an intermediate unit. Tube system 900 c/s sender oscillator—Rec amplifier—Rec rectifier speed control. All tubes are type RV12P400. Power supply 12-volt storage battery to motor. coupled to dynamo for H.T. for tube.	The mechanism of the set is simple but precision made, and the keyboard is continental type.
Telewriter Tbs/T 36 L.O. (Tape Teleprinter) <i>Fernschreiber</i>	$20" \times 16\frac{1}{2}" \times 12"$ —63½ lbs.	The receiving and transmitting mechanisms are similar to those in the American Teletype machine described in detail in the Teletype Manual No. 11. All cables are permanently attached to the teleprinter. Schematic and wiring diagrams will be found mounted on the meter base plate.	Associated equipment T.T.U., e.g. (<i>Spring Schreibschutzgerat</i>).
Speech Scrambler 9K III b.	$17" \times 13" \times 9"$ (approx.)—70 lbs.	These are used to provide two-way security on a wire or radio-telephone circuit. It is powered by a 2-volt storage battery and one, 90-volt dry battery. The set is compactly built and is very sturdy in construction. The individual circuit components are separated according to their functions and completely screened. 3RV2P800 are used. Two of these are used as audio amplifiers, one on each side of the two-way circuit. The other is used as a 2000-cycle audio-oscillator. If not required the scrambler circuit may be switched on and the input and output circuits directly connected.	Use for security purposes over telephone lines. Is portable and can be carried by 1 man.

Figure 52.

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**DETAILED DESCRIPTION OF GERMAN ARMY LINE COMMUNICATIONS
EQUIPMENT INCLUDING SWITCHBOARDS AND KINDRED EQUIPMENT—Continued**

NOMENCLATURE	DIMENSIONS AND WEIGHT	DESCRIPTION	REMARKS
<i>Tonschreiber</i> Models b and b1		Both models with the exception of one employing a synchronous speed control system are identical. They are divided physically into two sub units known respectively as the <i>Laufwerke</i> and the <i>Verstärker</i> . It offers the facility of recording an audio signal on a magnetic ribbon. During the recording process, the quality and ware of the signal impressed on the tape may be monitored. Provision has also been made for playback and for re-winding and wiping the tape used. This recording tape is made of paper; one side of it has been covered with a coating of material having high magnetic properties. The apparatus was designed to be supplied from AC mains. DC cannot be used. While the voltage may vary from 110 to 250 volts the permissible frequency variation is not known.	High speed recording apparatus. The Germans have designed and manufactured a series of magnetic tape recorders. There are in existence 2 other models known; they are: the <i>Tonschreiber c</i> which is a spring-driven recorder for rough field use; and the <i>AEG Type K4</i> , which is a studio type device.
German Teleprinter SWBD (T39) <i>Vermittlungsschrank</i>	21"x18½"x8¾"—50 lbs.	This teletypewriter switchboard is housed in a metal cabinet with folding tubular legs. It has four pairs of cords for handling simultaneous complete circuits and provisions for terminating one to ten teletypewriters. The construction is rugged and will withstand considerable abuse, although it is not moisture proof; the wiring is neat and sturdy. The answering and calling cords are each coiled on an individual wound reel. This method of storing excess cord lengths is same as that employed on the German 20-line, local battery telephone switchboard.	Line of communication companies.
German SWBD. 20 line.			
German <i>Relaiskasten T39</i> . Teletype Repeater.			
<i>Leitungsabschlusskasten</i> (Line Terminal Equipment)			

Figure 52 (Continued)

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIO SETS USED IN THE GERMAN ARMY GROUND FORCES

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPE OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transceiver <i>Torn.Fu.bl</i>	a. 3-5 b. 3-6.7	C.W. 25 R/T 10	a. MO-PA RV2 P800-RL2P3 b. RF-M-LO-IF-DET-AF 6RV2 P800	.65-C.W. .35-R/T.	a. 2-volt storage battery b. 130-volt H.T. dry bat- tery.	12-ft. (max.) rod or 50-ft. hori- zontal wire and counterpoise.	18"x15½"x8" —43 lbs.	Short range com- munication by all arms except infantry.	This set is identical with the <i>Torn. Fu.</i> <i>f.</i> except for fre- quency rang of sender.
Transceiver <i>Torn.Fu.a2.</i>	a. 33.8-38 b. 33.8-38	C.W.:9 R/T :4	a. MO-B-PA-MOD to PA grid 2,RV2P8000,-RL2T2 (Mod is rec. AF Tube). b. RF-M-LO-IF-REAC: DET-AF 6RV2 P800	1	a. 2-volt storage battery and 130-volt H.T. dry battery. b.	6 ft. rod (section- al) or wire on masts.	14½"x12½"x4½" —37 lbs.	Communication from infantry regt. (brigade) to battalion, and from bat- talion to corps.	
Transceiver <i>Torn.Fu.f.</i>	a. 4.5-6.7 b.				Same as for <i>Torn.Fu.bl.</i>			Communications from field ar- tillery troops to their observa- tion posts.	
Transceiver <i>SE 469A.</i>	a. 3-5 b.	C.W.:60 R/T :20	a. MO-PA (2 tubes in paral- lel) RS242-REO84. b. RF-Fc-2,IF-DET-AF 4,RESO94-,2 REO84.	15-C.W. 7-R/T.	Pedal generator, or 12-volt storage battery and dy- namotor. (6-volt battery and 150-volt H.T. bat- tery for receiver only).	Inverted L, 40-ft. long,10-ft high with two 20-ft. counterpoise cables.	19½"x16"x8½" —44 lbs.	For fire control in artillery units.	
Transceiver <i>Feldfu.b.</i>	a. 90-110 b. 90-110	R/T :3/4	a. MO-PA b. RF-DET-AF (Super- regenerative). RV2.4 P700-RL2.4T1-RL2, 4P2.	.15	a. Storage battery type 2.4 b. NC28 driving an inter- nal vibrato pack.	32"-vertical rod; later models have laminated steel tape.	14"x13½"x7" —28 lbs.	Short range pa- trol set, used by infantry in forward areas.	This set is a modern packset. The tubes used are of small dimensions and the whole set is compactly con- structed. The <i>Feldfu c.</i> is a sim- ilar set covering a different fre- quency range. They are distin- guished by a color code, the "b" hav- ing red markings and the "c" green.

Figure 53.

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIO SETS
USED IN THE GERMAN ARMY GROUND FORCES—Continued

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPE OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transceiver <i>Fusprech a.</i>	a. 24.1-25 b.	R/T -2	a. MO (Rec osc)-PA (Rec output (Grid MOD (Rec 1st AF) to PA. b. M-OSC-2,IF-DET-2,AF-	8	a. 12-volt storage battery to b. dynamotor SEUa. 12 volts @ .5 amps.	6½-ft. rod con- nected via feeder.	11"x8"x6" —15 lbs.	Inter-communi- cation between armored recon- naissance cars	
Transceiver <i>SEG2T</i>	a. b. 454-508	M.C.W. R/T 125.	a. MO-Anode Modulator DS310 (acorn) RL2T2. b. Quench-DET-AF RL2T2-DS310 (acorn) RV2P800.	40-60 m/W.	a. 2-volt storage battery, and two 90-volt H.T. dry batteries, tapped at 9, 60, 90, 130, and 180 volts. b.	Saw tooth reflect- ive aerial.	13½"x8¼"x8¼" —24 lbs.	For quasi optical point to point working. Not known which troops use it.	
Transceiver <i>Torn.Fu.g.</i>	a. 2.5-3.5 b. 2.5-3.5	C.W.:15 R/T : 8	a. MO-PA. 2,RL24P3. b. RF-FC-IF-DET-AF 5,RV2,4P700		a. 2.4-volt storage battery and built in vibrator. b.	On move whip aerial 5-ft. long with loading coil at base.	15"x13"x7"	As a pack set on the move or as a ground sta- tion.	This set is provided with "Break" in working.
Transceiver <i>Feldfu.f.</i>	a. 28-33 b. 28-33				Same as for <i>Feldfu b.</i>	4-ft. rod.		By troops sup- porting ar- mored fighting vehicles.	Main features dis- tinguishing this set from the <i>Feld- fu.b.</i> are: (1) tuning is contin- uous, not in fixed channels; (2) ac- rial base is tilted so that aerial is 40° out of vertical; (3) a large white spot.
Transceiver <i>Feldfu.al.</i>	a. 120-156 b. 120-156	R/T 11		.15 watts	a. 2-volt storage battery, type 2B19. b. and 90-volt H.T. battery	Rod: short, 2 ft.; long, 6 ft.	14"x13"x4¼" —26½ lbs.	By infantry.	The name of this set is also abbreviated to <i>Fuspal.</i>
Transceiver <i>Fusprech.f.</i>	a. 19.9975- 21.4725. b.	R/T: 2			Same as for <i>Fusprech.a.</i>	4'7"-vertical rod.		Intercommuni- cation between self-propelled guns.	This set is practi- cally identical with the <i>Fusprech.a.</i> ex- cept that the <i>Fus- prech.a.</i> has a re- ceiver fire control.
Transceiver <i>Fusprech.d.</i>	a. 23.11-24.01 b.								
Transceiver <i>Torn.Fu.c.</i>	b. 1.5-2.3 b. 1.5-2.3	C.W.:15 R/T : 7			Same as for <i>Torn.Fu.bl.</i> and <i>Fu.f.</i>			For artillery ob- servation.	

Figure 53 (Continued).

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIO SETS USED IN THE GERMAN ARMY GROUND FORCES—Continued

NOMEN-CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPE OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transceiver <i>S.E.a.2/24b-202.</i>	a. 3-6.67 b. 3-6.67	M.C.W.: 15 R/T : 5	a. MO-PA. b. (3,REO84K,-2RE134,-1,4406D or 1,RESO94.)	5	a. 2-volt storage battery (NC-10). b. Two 90-volt dry batteries.	Rod or wire.	18"x14"x8" —35 lbs.	Used in defensive positions.	This is an old Lorenz commercial set designed before the war.
Transmitter-Receiver <i>15. W.S.E.a.</i>	a. 3-7.5 b. (2 Bands).	C.W.: 60 R/T : 20	a. 3,RL4.8P15-1,RV2.4P700 b. 8,RV2.4P700.		a. Pedal generator type b. 15A and rectifier with storage battery 2.4NC58; 12-volt storage battery in vehicle with convertor type 15A and rectifier.	High rod antennae with counterpoise or vehicle roof antennae.	39½ lbs.	From artillery division down to lower formations.	
Transmitter-Receiver <i>DMG 4K DMG 5K</i>	a. 500-600 b. 500-600	N.C.W.: 60 R/T : 30		0.5-1	a. 220 volts AC supply or b. 220-volt, 50-cycle, gasoline driven alternator.	Two broad-band directional arrays, 1 for Xmitter, 1 for Rec. DMG 4K. 3 rows of dipoles.	Rack— 46"x20½"x12½" Base— 25½"x26"x20" Cases for antennae 66x51x10. Total weight 900 lbs.	These sets are used for multi-channel communication over limited distances.	
Transceiver <i>Form.Fu.G.k.</i>	a. 4.5-6.7 b. 3-6.7	a. C.W.: 15 R/T : 7 b. (C.W.M.C.W. R/T.)	a. MO-PA (2 tubes in parallel) RI2.4P2-2,RI2.4P2 b. RF-M-LO-IF-DET-AF 6,RV2.4P700 (IF amplifier used for transmitter modulation).	1.5	a. Two nickel iron 2.4-volt b. storage batteries (type N.C.58a) and vibrator-power pack SEWg.	12-ft. vertical rod or horizontal 33-ft. wire.	17.2"x13½"x7½" —45.5 lbs.	Is replacing <i>Form.Fu.bl.</i> in artillery units.	Very similar to <i>Fu.bl.</i> except for frequency range and transmitter construction.
Transmitter <i>120.</i>	a. 42.1-54	C.W. M.C.W. R/T		120		70-ft. mast with vertical stub aerial on top.		Army corps and Hq.	
Transmitter <i>AS-59.</i>	a.	C.W. M.C.W. R/T	a. MO-B-PA (Push-Pull) RLT15-RS391-2.RS391.				25"x21"x18¾" —100 lbs.	Not known.	
Transceiver <i>PH1.1.UK43</i>	a. 37.5-462.2 b.	R/T	a. 2.K.D.D.-2,DF25. b.	1.	a. Three 4.5 volt batteries in parallel. b. One 150-volt H.T. batteries. .3 amps. @ 4.5 volt. 40 m/a @ 150 volt.	¼ wave pole (1.75 meters) ½ wave pole (2.40 meters)	11¾"x15¾"x14" (approx.) 33 lbs.	Not known.	

Figure 53 (Continued).

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS FOR GERMAN GROUND RADIO TRANSMITTERS

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transmitter 5WS/24b-104	a. .95-3.15	C.W.: 36 R/T: 10	a. MO-PA 2, RS 241	5-7	a. Pedal generator. Storage battery and dynamotor U.S. A.L., or gasoline motor generator. 3.8 Volts @ 1.2 amps. 300-330 volt @ .14 amps.	Horizontal wire. vehicular rod. Counterpoise 50 ft. long.	18"x14 1/8"x7 5/8" —52 lbs.	Regimental and Divisional nets may be employed for vehicular or ground use.	A general medium frequency low power transmitter.
Transmitter 10W.S.c.	a. 27.2-33.3	M.C.W.: 4 R/T: 2 1/2	a. MO-MOD-PA RL 12, P.55-RV 12, P.4000-RV 12.P. 35.	6.5 (10 Max.)	a. 12-volt storage battery and dynamo U-10AL 12 volts @ 2 amps. 350 volts @ 100 m/a.	6 1/2-ft. rod on move. Mast sections and gear provided for ground use.	7 1/2"x12 1/2"x7" —22 lbs.	Armored vehicles. Generally tank units. Usually in Commander's tank.	This is similar to the 10W.S.b. but for calibration and frequency range 10W.S.b. frequency range is 23-24.95 mcs.
Transmitter 8W.S.	a. 1-3	C.W. R/T	a. MO-PA 2, R1 12 T15	8 (Can be reduced to 1/4 power)	a. Pedal generator, engine generator or 12 volt storage battery and dynamotor. 12 volts @ 1.25 amps. 350 volts @ 75 m/a.	66-ft. "L" type or 33-ft. T type.	20"x12"x11" —48 1/2 lbs.	Regimental command and reconnaissance nets.	
Transmitter 20W.S.c.	a. 27.2-33.3	M.C.W. -3 R/T -2	a. MO-D-MOD-PA; (PA-Push pull) 5, RL 12 T15	20	a. 12-volt storage battery and dynamotor U-20A, U-20A2 or U-20A3. 12 volts @ 2.75 amps. 370 volts @ 130 m/a.	4 1/2-ft.—6 1/2-ft. whip type.	19"x8 1/2"x10" —30 lbs.	Tank formations generally.	A similar set is the 20W.S.d. but which has a frequency range of 42.1-47.8.
Transmitter 20W.S.b.	a. 25-27	R/T		20	a. 12-volt storage battery to dynamotor U-20A3.	8-ft. vertical rod via feeder.	19 1/4"x8 3/4"x9 1/4" —35 lbs.	By sound ranges in artillery units.	Very similar to 20W.S.c. except for modulator control and indicator.
Transmitter AKS 25.	a. 3-6	C.W.: 50 R/T: 15	a. MO-D-MOD-PA; (PA-Push pull). 5 RL 12 T15.	25	a. Engine driven or pedal driven generator. 12.5 volts @ 2.5 amps. 350 volts @ 250 m/a.	33-ft. wire on one 33-ft. mast with 4-33-ft. counterpoise.	17 1/2"x12"x14 1/2" —60 lbs.	In infantry divisions and artillery regiments.	
Transmitter 30W.S.a.	a. 1.1-3.01 (3 Bands)	C.W.: 50 R/T: 16	a. MO-MOD-PA (2 tubes in parallel) (Mod: 2 tubes in parallel) 2 RL 12, P 35-2, RV 12 P.20001.RL12T15.	30	a. 12 volt storage battery to dynamotor U-30 b.	Vehicular rod or roof antennae. Open wire antennae.	19"x9 3/4"x9 1/4" —42 lbs.	Small signal units and signal troops in armored corps.	Medium powered field transmitter. This set is identical with the 80W.S.a. as regards its circuit.

Figure 54.

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PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS FOR GERMAN GROUND RADIO TRANSMITTERS—continued

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NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transmitter <i>30W.S./24b-120</i>	a. .95-1.68	C.W.: 25 R/T: 10		30	a. 12-volt storage battery to dynamotor U-30A.		19"x11 $\frac{1}{4}$ "x11" —56 lbs.	Armored cars and other vehicles and reconnaissance nets of division troops.	
Transmitter <i>70W.S.</i>	a. 3-16.667	C.W. 36		70	a. 12-volt storage battery to dynamo U-30A.	Rod, or 25-40-ft. single wire.	21 $\frac{1}{4}$ "x11 $\frac{1}{4}$ "x19 $\frac{1}{8}$ " —78 lbs.	Used by all reconnais- sance units within command nets.	
Transmitter <i>80W.S.a.</i>	a. 1.12-3.0 (3 Bands)	C.W. 125 R/T 45	a. MO-MOD-PA (PA-2, tubes in par- allel) MOD 2, tubes in parallel (3RL 12. P.36, 2 RV 12 P2000.)	80 (or 10)	a. 12-volt storage battery to dynamo U-80A.	8-meter vertical mast vehicu- lar rod or roof aerial.	18 $\frac{1}{2}$ "x11 $\frac{3}{4}$ "x10" —48 lbs.	In tank division to tank brigade sets.	
Transmitter <i>100W.S.</i>	a. 0.2-1.2	C.W.: 200 R/T: 70	a. MO-MOD-PA RS-237-RS 241-RS 237.	100 (or 10)	a. Storage battery to dyna- motor U-100 or U-100A 12 volts @ 30.8 amps. Field gasoline division D-C generator. 12 volts @ 7.3 amps. 1000 volts @ 240-300 m/a.	1-33-ft. mast with 4-spoke antennae (me- dium fre- quency) or one 20-ft. sec- tional mast with 3-spoke umbrella (higher fre- quency)	18 $\frac{1}{2}$ "x18"x10" —76 lbs.	Administrative con- trol set for large areas. Can be used in vehicle or as a fixed station.	A commercial design adapted for mili- tary use. Provision made for local or remote control and picture transmitter. High-low power switch for C.W.
Transmitter <i>1000W.S.b.</i>	a. 1.090-6.7 (4 Bands)	C.W. -700 M.C.W.-700 R/T-150-300	a. MO-B-PA MO and Buffer RS 282, PA. RS 329G Key- ing Section 2, RS 282 and 3 RGN 2004 Amp. Sec- tion 2, RS282 and 3RE 084K.	1,000	a. Dynamotor U-1000 to AC line, or M.G. gas en- gine set.	(2) Two 80-ft. masts sup- porting single wire antennae 83-ft. for me- dium fre- quency and 33-ft. long for high fre- quency.	5'2"x3'4"x6' $\frac{3}{4}$ " —1630 lbs.	Army and corps staffs, also used for liaison as ground set to <i>Luftwaffe</i> .	

Figure 54 (Continued).

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PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS FOR GERMAN GROUND RADIO TRANSMITTERS—continued

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Transmitter 1500W S.a.	a. 0.1-66 (4 Bands)	C.W. : 725 M.C.W.: 725 R/T : 18-340	a. As for 1000 W.S. b. Except that P.A. tubes are RS 239.	1,500	a. Dynamotor to V-1500 AC line or M.G. gas en- gine set.	80-ft. mast with 6- or 12-ft. spoke "um- brellas."	5'2"x3'3"x6'3/4" —1430 lbs.	For communication between corps ground headquar- ters, and army staff.	A 3-stage transmitter for installation in motor cars and fixed stations. It is divided into several components for speedy removal as- sembly and replace- ment.
Transmitter 60W (Jamming)	a. 18.75-61.25	C.W. Freq. Mod.	a. MO/D-PA (Freq. Mod.) 3, PE 06/40-(EL 2)	60	AC single phase, 50 cycle, 110 volts.		20"x12 1/2"x12 1/2"		A special type of transmitter de- signed for jamming.
Transmitter 600H. (S.W. Jamming)	a. (a) 1775-17.85 (b) 15.1-15.35 (c) 11.7-11.9 (d) 9.5-9.7 (e) 7.2-7.3 (f) 6.-6.2	M.C.W. Freq. Mod.	a. MO/D-(Freq. MOD/PA) 2, PE 06/40-PB 3/1000	6,004	a. AC three phase, 50 cycle, 180/200 volts.		75"x27"x27" —880 lbs.		This special S.W. jamming apparatus is made in 6 models corresponding to the 6 models as shown in column 2. Each band has a variable frequency.

Figure 54 (Continued).

PERFORMANCE CHARACTERISTICS FOR RADIO TRANSMITTERS USED AS GERMAN ARMY MESSAGE CARRIER EQUIPMENT

Nomenclature or Designation	No. of Channels	Frequency Range Kcs.	Carrier Frequencies Kc.	Ring- ing Fre- quency	Max. Line Attenuation. db. and Nepers	2mm C. Open Wire	Ranges (Km. and Miles) 3 mm Cu Open Wire	Field Cable (FFK)
T.f. a	1	3.4-8.2	5.8	500/20	4.0 np. 34.76 db.	400 Km. 250 Miles	520 Km. 325 Miles	25-60 Km. 16-37 Miles
T.f. b 1.	1	3.5-7.5	5.5	500	3.6 np. 31.28 db.	400 Km. 250 Miles	500 Km. 325 Miles	25-50 Km. 16-31 Miles
T.f. b 2.	1	9.0-13.0	11.0	500	3.6 np. 31.28 db.	320 Km. 200 Miles	400 Km. 250 Miles	15-30 Km. 9-19 Miles
T.f. b 3.	1	16.5-20.5	18.5	500	3.6 np. 31.28 db.	220 Km. 137 Miles	280 Km. 175 Miles	
T.f. b 4.	1	22.0-26.0	24.0	500	3.6 np. 31.28 db.	160 Km. 100 Miles	200 Km. 125 Miles	
E. 1.			Same as for T.f. a.					
E. 2.	1	3.4-8.2	5.8	500/20	2.0 np. 17.38 db.	230 Km. 144 Miles	290 Km. 181 Miles	10-30 Km. 6-19 Miles
E. 3.	1	3.7-10.0	6.4; 10.3.	500	3.75 np 32.49 db.	350 Km. 219 Miles	450 Km. 281 Miles	18-45 Km. 11-28 Miles
T. 1.	3	6.6-28.2	6.3; 9.4; 12.9 20.7; 24.4; 28.5	500/20	4.0 np. 34.76 db.	270 Km. 169 Miles	350 Km. 219 Miles	
T. 3	3	8.8-30.4	7.7; 10.9; 14.3 19.8; 23.7; 27.7	500/20	4.0 np. 34.76 db.	270 Km. 169 Miles	350 Km. 219 Miles	
T.f.R. (Rundf) (Broadcasting)	1	34.0-42.8	42.8					
MEK	8.	6.0-60.0	6:9:12:15:18 21:27:36:39: 42:45:48:51 54:57		4.0 np. 34.76 db.		250 Km. 156 Miles	

LINE EQUIPMENT—German Carrier Equipment (Army and Commercial)

The German carrier equipment, both commercial and army is listed above. It is similar to the American in design, channel frequencies, and use. Diagrams (not shown here) authenticate this, and show that the carrier practice in line and repeater set up are practically identical.

Within the German army the most common sets for field use are the *Tragerfrequenzgerat a* (T.f.a.) and the *Tragerfrequenzgerat b* (T.f.b), including b1, b2, b3, and b4. Other sets in use by the Germans are: *Mehrfach* (MEK) MG, MK, T1, T3, E1, E2, and E3; the MG and MEK carrier systems are apparently more recent additions.

The "L" and "U" carrier systems for cable, are used by the German PO. The "L" system is installed on lightly loaded cable, and the "U" or non-loaded cable. The German broadcasting carrier system is the *Tragerfrequenzgerat Rundfunk* (TfR)—"Carries Broadcasting."

Differentiation is made with multiple T1 (carrier) systems between single channel systems (transmission channels for EW and WE traffic lie directly next to one another, as in the case of sets T.f.a. and T.f.b.) and group systems (the channels for each carrier direction are adjacent and they form therefore, two separate groups, e.g. sets MEDK and MG).

Abbreviations and Nomenclature:—

a. Carries Equipment:—

- (1) T.f. (a or b), *Tragerfrequenzgerat*, Carrier Frequency Set.
- (2) MEK., *Mehrfach-Einzelkanal*, Multiple Channel.
- (3) T.f.R., *Tragerfrequenz Rundfunk*, Carrier Frequency Broadcasting.
- (4) E (1, 2, 3); T (1, 3); MG; M (1-7); MK EK; L; U:—Meanings not known.

On the chart above, kilometers are converted to miles and nepers (standard German power level unit) to decibels.

1 neper equals. 8.6858 decibels.

1 decibel equals. 0.11513 nepers.

Figure 55.

PERFORMANCE CHARACTERISTICS FOR RADIO TRANSMITTERS USED AS
GERMAN ARMY MESSAGE CARRIER EQUIPMENT—Continued

Nomenclature or Designation	No. of Channels	Frequency Range Kcs.	Carrier Frequencies Kc.	Ring ing Fre- quency	Max. Line Attenuation, db. and Nepers	2mm C. Open Wire	Ranges (Km. and Miles) 3 mm Cu Open Wire	Field Cable (FFK)
MG	15.	48-156		500/20	4.0 np. 34.76 db.		100 Km. 62 Miles	
M 1	3	5.8-38.4						
M 2 (M3)	4	5.2-39.7						
M 4 (M5)	3	12.2-29.7						
M 6 (M7)	4	8.7-43.7						
MK (K 1)	5	57.6-142.4	60:68:76:84:92: 108:116:124: 132:140		4.0 np. 34.76 db.			
MK (K 2)	5	53.6-138.4	56:64:72:80:88 104:112:120: 128:136:		4.0 np. 34.76 db.			
MEF	5	10.3-57.6	10:20:30:40:50 15:25:35:45:55					
EK	1	41.5-54.5	44:52,					
Erickson (12 Kanal)	12	49.3-154.4						
L-(Kabel-System) DRP	1	3.3-5.8	6					
U-(Kabelsystem) DRP	12	12.3-60.0						

Figure 55 (Continued).

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS FOR GERMAN INTERCEPT, GENERAL PURPOSE, AND SPECIAL PURPOSE RADIO RECEIVERS

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL	CIRCUIT AND TUBES (a) Send (b) Receive	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Receiver <i>Fu.H.E.c.</i>	b. 3.0-25.8 (4 bands)	C.W. M.C.W. R/T	b. 2, RF-M-LO-3, 1F-DET-OBFO-AF 10, RV 2P800	b. 2-volt storage battery and 90-volt H.T. dry battery. 2-volts @ 1.7 amps. 90-volts @ 12 m/a.		18"x14"x10" —56 lbs.	Intercept service. Moni- toring for security.	It is very difficult to service. Is one of a series of four intercept receivers.
Receiver <i>K.w.E.a.</i>	b. .98-10.2	C.W. R/T	b. 2RF-M-LO-3, 1F-DET-BFO-AVC-AF. 11, RV 2P800	b. 2-volt storage battery and 90-volt H.T. dry battery, or Converter unit <i>EU.d.</i> or main unit <i>NA6.</i>		27"x10½"x13½" —91 lbs.	For stationary or semi- mobile services. All arms.	
Receiver <i>UKw.E.f.</i>	b. 42-48	M.C.W. R/T	b. RF-FC-1F-DET-AF. 5, RV2-4P700	b. 2.4-volt storage battery for internal H.T. vibrator.	6½-ft. vertical rod when used as pack set.	14"x12½"x6½" —17 lbs.		The associated sender is the <i>20 W.S.d.</i> When used alone the aerial base and rod are mounted on top of the case.
Receiver <i>Torm Eb.</i>	b. .096-7.095 (8 bands)	C.W. M.C.W. R/T	b. 2, RF-DET-AF. 4, RV 2P800	b. 2-volt storage battery and 90-volt H.T. battery, or 12- volt storage battery and vi- brator unit <i>E.W.c.</i> 2-volts @ 0.75 amps. 12-volts @ 1 amp.		9½"x14¼"x8¼" —29 lbs.	General purpose receiver.	
Receiver <i>L.M.W. H.E./24b- 316</i>	b. .075-3.333 (5 bands)	C.W. M.C.W. R/T	b. RF-M-LO-1F-DET-AF. (RF-M-1F-RES 094) (LO-DET-AF RE 084K)	b. 4.8-volt storage battery; four 30-volt or 90-volt plus one 30- volt H.T. batteries. 4.8-volt @ .45 amps. 100 volt @ 18 m/a.	Open wire and coun- terpoise.	18½"x15½"x9" —44 lbs.	Intercept receiver.	This set is an old design and is being replaced by inter- cept receivers <i>Fu.H.E.a.</i> and <i>b.</i>
Receiver <i>Fu.H.E.d.</i>	b. 25-60 (4 bands)	C.W. M.C.W. R/T	b. 2, RF-M-LO-3, 1F-DET-BFO- 2, AF A11 RV2 P800	b. 2-volt storage battery and 90-volt H.T. dry battery. (2.4-volt storage battery may be used after internal adjust- ment to set.)	15-ft. open wire on sectional masts and counterpoise.	18"x14"x10" —56 lbs.	Intercept receiver for U.H.F. signals.	This receiver is similar in every respect to the <i>Fu.H.- E.c.</i> except in frequency range and number of tubes.
Receiver <i>WR 1P.</i>	b. .15-15.5	M.C.W. R/T	b. FC-2, 1F-DET/AF- Driver Class 'B' Output DCH 25-2, DF25-DAC25- DC25-DDD25 DF26	b. AC or DC mains supply 90- 250. Volts (voltage need not be known), or, two 1.25 dry cells <i>ENL DIN VDE.</i> 1210 plus 90-volt A.T. battery from mains 0.25 amps.		19½"x16"x11½" —57 lbs.	For broadcast reception. With the aid of a micro- phone it can be used for oral transmission of or- ders.	Can be used as a microphone amplifier.
Receiver <i>UKW.E.e.</i>	b. 27.2-33.3	M.C.W. R/T	b. RF-M-LO-2, 1F-DET-AF 7 RV 12 P4000.	b. 12-volt storage battery to dynamotor <i>EUa2.</i>	6½-ft. vertical rod.	12½"x8"x7" —22 lbs.	Communication through- out a tank battalion.	

Figure 56.

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS FOR GERMAN INTERCEPT,
GENERAL PURPOSE, AND SPECIAL PURPOSE RADIO RECEIVERS—Continued

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL	CIRCUIT AND TUBES (a) Send (b) Receive	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Receiver <i>M.W.E.c.</i>	b. .835-3	C.W. M.C.W. R/T	b. RF-M-LO-2, IF-BFO/ Calibrator DET-AF (2 tubes in push pull) ALL RV12 P200	b. 12-volt storage battery to dynamotor <i>EU.a.1</i> , 2, or 3. 12-volts @ 4-5 amperes.	Open wire or roof aerial.	12½"x8"x7" 24 lbs.	Communication receiver for medium waveband.	
Receiver <i>Fu.H.E.u.</i>	b. .5-25 (5 bands)	C.W. M.C.W. R/T	b. 1 9-tube superhetrodyne.	b. As for <i>Fu.H.E.c.</i>		17"x13½"x10 —56 lbs.	Intercept services.	Very similar to <i>Fu.H.E.c.</i> but for frequency range and circuit.
Receiver <i>L.W.E.e.</i>	b. .072-1.525 (5 bands)	C.W. R/T	b. RF-M-LO-2, IF-DET-BFO-AF 8, RV2 P 800	b. 2-volt storage battery and 90-volt dry H.T. battery or converter unit <i>EU.a.</i> or mains unit <i>NA6</i> .		27"x13½"x10½" —87 lbs.	Long range communica- tion at army and com- mand hq.	Similar in construction to <i>K.W.E.a.</i> except that the <i>K.W.E.a.</i> has fewer stages and no A.V.C.
Receiver <i>Spez.445b.</i>	b. .1-6.7	C.W. R/T	b. RF-REG DET-2,AF 4, REO 74	b. 4.8-volt nickel-iron storage battery and 90-volt H.T. dry battery.	Long wire or rod.	18"x14"x8½" —55 lbs.	General purpose receiver.	
Receiver <i>UKW.E.d</i> 1.	b. 42.1-47.8	M.C.W. R/T	b. RF-M-LO-3, IF-2nd DET-AVC-AF 9 RV12 P2000	b. Dynamotor <i>EU.a.2</i> or 130- volt dry H.T. batteries and 12-volt storage battery.	6½-ft. rod connected via feeder.	15½"x10"x8" —19 lbs.	By signal and armored troops for ground-air cooperation.	Very accessible for servicing.
Receiver <i>UKW.E.h.</i>	b. 23-24.95	M.C.W. R/T	b. RF-M-LO-2, IF-DET-AF 7, RV12 P4000	b. 12-volt storage battery to dynamotor <i>EU.a.1</i> , 2, or 3.	6½-ft. rod.	12½"x8"x6½" 22½ lbs.	Armored troops in cars and assault guns, model G.	Very similar to the <i>U.KW.-</i> <i>e.</i> except for frequency range.
Receiver D/F Ground <i>L.M.W.P./</i> <i>240-315.</i>	b. .075-3.333 (5 bands)	C.W. M.C.W. R/T	b. RF-M-LO-IF-DET-BFO- AF 2, RES094, RE084K- RES094, 2, RE084K respectively.	b. 4.8-volt storage battery (<i>NC-</i> <i>10</i>); four 30-volt or one 90- volt plus one 30-volt H.T. dry battery. 4.8-volts @ .45 amps. 100-volts @ 18 m/a.	Goniometer loops. about 1 square me- ter each, and aux- iliary aerial (1-me- ter rod or 3-meter horizontal wire).	21"x14½"x8½" —51 lbs.	Used by subsection of in- tercept company.	The circuit is the same as the intercept receiver <i>L. Mw.</i> <i>HE/246-316.</i>
Receiver (Radio Controlled Tank) Set <i>B4 Fu.E6.</i>	b. 24.6 c. Crystal	R/T	b. FC-IF-IF,AVC, DET-AF-AF ECH 11-EF 13-EBF 11-2, EF12.	b. Dynamotor with 12-volt stor- age battery.	4-ft. flexible rod.	7.1"x10.6"x3.1"	For radio controlled tank in conjunction with an audio filler unit which is not listed here.	

Figure 56 (Continued).

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIOS AND EMERGENCY TRANSMITTERS USED IN GERMAN AIRCRAFT

NOMEN- CLATURE	FRE- QUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT a. Send b. Receive	ALLOCATION	REMARKS
Transmitter- Receiver <i>Fu.G3.</i> (Airborne)	a. .3-.6 and b. 3- 6	C.W. M.C.W. R/T	a. 3, RS31-3, R2074 & 1, R.2134.	100 (High) 20 (Low)	a. Air driven generator (G3) b. Two 90-volt batter- ies, one 4-volt Edison.	Both fixed and trailing		Bomber aircraft; found in some but not all specimens of the fol- lowing types of air- craft: <i>Ju 52, FW 58,</i> <i>HE 114, DO 11, 13,</i> <i>& 17E & F; AR 66,</i> <i>AR 96, W 33 and 34.</i>	Similar sets <i>Fu.G3 A.</i> and <i>Fu.G3 AU.</i> Both the above sets are still in use in transport aircraft, flying boats, and second-line obso- lescent aircraft gener- ally.
Transmitter- Receiver <i>Fu.G7,</i> <i>7a, 7c.</i> (Airborne)	a. 2.5-3.75 b.	a. C.W./RT -15 b. M.C.W. R/T	a. 2, REN 904,- 2, RENS 1664 b. 5, RENS 1264.	20	a. Dynamotor U4A/24. b.	Fixed antennae in fight- er aircraft: In dive bombers a trailing antennae manually reeled.	a. 14"x9"x8" —20 lbs. b. 14"x9"x8" —25 lbs.	In fighter aircraft and dive bombers. Prior to 1943, 7A was fitted in <i>ME 109, ME 109</i> <i>F, FW 190.</i> It is still fitted in <i>JU 87</i> and <i>HS 129.</i>	Was replaced by <i>Fu.</i> <i>G16Z.</i> Is still used, however, in twin seat- er aircraft particular- ly the <i>JU 87.</i>
Transmitter- Receiver <i>Fu.G8.</i> (Airborne)	a. S.W. 3-6: L.W. b. .3-.6	a. (L.W:C.W.) (SW:CW.R/T) b. (C.W.M.C.W., R/T)	a. 9, RS 242 b. 4, NF 2 and 3NF 3	20 (S.W.) 40 (L.W.)	a. Dynamotor (U5) b. Dynamotor (U6)	Common T and R. Fixed or trailing an- tennae may be used.		Air-to-air-to ground (intercommunica- tion).	Intended originally for bomber aircraft but was superseded by <i>Fu.G10.</i>
Transmitter- Receiver <i>Fu.G10.</i> (Airborne)	a. As for <i>Fu.G8</i> b.	a. C.W.-R/T. 300-500 b.	a. 6, RL 12P35-25, RV12 P2000 b.	40 (S.W.) 70 (L.W.)	a. Dynamotor U-10/S b. Dynamotor U-10/E	Both fixed and trailing. Aerial tuning units, AAAG-2 and AAAG- 3 are provided.	a. 9"x8¾"x8" —16½ lbs. b. 7¼"x8¾"x8" —16 lbs.	Current equipment for all first line multiple engine aircraft.	
Transmitter- Receiver <i>Fu.G16.</i> (Airborne)	a. 38-42.5 b.	a. R/T. 20-100 b. 20 ground level 100 in the air	a. 2, RL12P35- 11, RV12 P2000 b.	10	a. Dynamotor U-17 b.	Fixed single wire 6'11" long	a. 15"x8¼"x8" —26½ lbs.	All bombers. Air-to-air and ground liaison.	Is fitted in large aircraft in addition to the <i>Fu.G10.</i> The design was taken from the <i>Fu.G17.</i>

Figure 57.

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PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIOS AND
EMERGENCY TRANSMITTERS USED IN GERMAN AIRCRAFT—Continued

NOMEN- CLATURE	FRE- QUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT a. Send b. Receive	ALLOCATION	REMARKS
Transmitter- Receiver <i>Fu.G16</i> <i>Z.ZE.</i> (Airborne)	a. b. As for <i>Fu.G16</i>	a. M.C.W. b. R/T. 20 ground level 100 in the air	a. 2, RL 12P35 b. 9, RV 12P2000 7, RV 12P2000 in navigational aid equipment.	As above	a. Dynamotor U-17 b.	Fixed single wire 6'11" long. Matching units AAG16-2 and AAG- 16-3 permit use of leading edge of the tail fin as antennae 8" single loop is used for D/F homing.	a. 15"x8 $\frac{1}{4}$ "x8" —26 $\frac{1}{2}$ lbs.	Used in all single seater fighters.	Also incorporates D/F homing apparatus.
Transmitter- Receiver <i>Fu.G17</i> <i>17E</i> and <i>Z.</i> (Airborne)	a. 42.1-47.9 b.	a. M.C.W. b. R/T. 30 at ground level 185 in the air	a. 2 RL 12P35,- 13, RV12 P2000 b.	As above	a. Dynamotor U-17 b.	Vertical rod about 39" long terminating in matching unit AAG7.		In twin seater, close supporting aircraft. Air-to-air-to ground liaison.	<i>Fu.G17</i> was the original design from which <i>Fu.G16</i> was copied.. <i>Fu.G 72</i> is used alter- natively with D/F homing apparatus.
Transmitter- Receiver <i>Fu.G1</i> and <i>G2.</i> (Airborne)	a. .6-1.667 b.	a. C.W. b. C.W. M.C.W. R/T.	a. 3, RS-31G- 3, R2074- b. 1 R 2134	20-100	a. Air driven generator b. Batteries	Fixed.		For bombers.	
Transmitter- Receiver <i>Fu.G6, 6A</i> (Airborne)					As for <i>Fu.G7</i>			Interrogation and com- mand. Air-to-air-to ground.	
Transmitter- Receiver <i>Fu.G10 K-1</i> (Airborne)	a. 5.3-10 b.	a. R/T. b. M.C.W.-R/T.	a. 2, RL 12P35-11 RV 12P2000 b.	10	a. Dynamotor U-17 b.	Single wire 6'11" long.		Command liaison set.	

Figure 57 (Continued).

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF TWO-WAY RADIOS AND EMERGENCY TRANSMITTERS USED IN GERMAN AIRCRAFT—Continued

NOMEN- CLATURE	FRE- QUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPES OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY AND CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT a. Send b. Receive	ALLOCATION	REMARKS
Transmitter- Receiver <i>Fu.G10 K-2</i> (Airborne)	a. 6-12 b.							Command and liaison set. Used in small aircraft.	
Transmitter- Receiver <i>Fu.G10 K-</i> (Airborne)	a. 6-13 b.							Voice communication air-to-air-to ground.	
Transmitter- Receiver <i>Fu.G21.</i> (Airborne)	a. .3-.9 b.	a. M.C.W.-R/T. b.	a. 3, RS 241- 1, RESO94- 2, RESO74 b.	10				Communication (gen- eral) for flying boats and seaplanes.	
Transmitter- Receiver <i>Fu.G25 a.</i>	a. 152.2-161 b. 123-128		a. L550 b. 6, RV12P2000,- 2, LD1.	440	a. Dynamotor b.	14" Stub, common to Trans.-Receiver. (Antennae tuning unit AAG25 a).	14"x8"x8" —33 lbs.		
Transmitter <i>NS2.</i> ("Not- sender") (2a, 2b)	a. 0.5.	C.W.: M.C.W.: 250 at sea, 120 overland	a. AL5N-RE13A.	8	a. Hand generator	Steel antennae wire 235 feet long with ground wire and sender raised by box kite or hydrogen filled bal- loon.	11"x10"x7½" —15 lbs.	Emergency transmitter for dinghy use.	Carried loose in aircraft. Forerunner of <i>N.S.I.</i>
Transmitter <i>NS4.</i> ("Not- sender")	a. 53.5-61.0	C.W. at 200 feet to air craft 9, at 1000 feet is 14, 40,000 feet 40.	a. 2, LS 1 and LS2	1-2	a. 11 midget storage cells—3 used in par- allel for 2-volt fila- ment, 8 used in series parallel for 8-volt vibrator supply.	Strip of copper plate steel tape 3'5" long and 1' in diameter tapering to 3/16" at end.	6¼"x6¼"x3" —3½ lbs.	Emergency transmitter for dinghy use.	Replaces the <i>N.S.2.</i> Standard equipment on all twin engine and larger aircraft.

Figure 57 (Continued).

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PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF RADIO EQUIPMENT INSTALLED IN GERMAN AIRCRAFT FOR DIRECTION FINDING, BLIND LANDING, BLIND BOMBING AND HEIGHT FINDING

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPE OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY & CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
D/F Receiver <i>Peil: 4.</i>	b. 0.25-0.4	C.W. M.C.W. R/T 150 (approx.)	b. 8 Tube superhetrodyne 8 RV 12 P200		b. Dynamotor U-8 and aircraft bat- tery.	Fixed loop 13" long and 3½" in diam- eter, carries 13 turns of Litz wire crosswound in series.	b. 11"x9½"x6" —22½ lbs.	Homing receiver used in single seater fighters prior to intro- duction of <i>FUG 16Z.</i>	
D/F Receiver <i>Peil: 5.</i>	b. .165-1	C.W. M.C.W. R/T 250	b. 6 Tube superhetrodyne 6 NF 2		b. Dynamotor U-8 and aircraft bat- tery.	Oval loop with pow- der Ironb. cone: 8 turns of Litz wire connected in series.	24"x10"x8" —24 lbs.	D/F and homing receiver in twin engine and larger aircraft for above pur- pose.	A pre-war commercial set.
D/F Receiver <i>Peil: 6</i>	b. .15-1.2	C.W. M.C.W. R/T	b. 6 Tube superhetrodyne 6 RV 12 P2000		b. Dynamotor U-11A	Oval loop: sense antenna is metal paint on loop housing.	b. 9½"x8½"x7" —20 lbs.	Used in bombers. May be used as a separate receiver in <i>FUG 10.</i>	One of the few German sets that uses crystals.
D/F Receiver <i>Peil: 7.</i>	b. .15-1.2	C.W. M.C.W. R/T			b. Dynamotor U-11A	Same as above.			
Navigation Receiver <i>FU 1 EBI.</i>	b. 28.5-35	R/T 250	b. 2NF2 TRF		b. Dynamotor U-8	39-ft. vertical rod.			Carried loose in aircraft for blind landings.
Navigation Receiver <i>FU 2H.</i>	b. 30-33.3		b. 7 Tube superhet: 7RV12 P4000		b. Dynamotor U-8	39-ft. vertical rod.			For blind landings.

Figure 58.

PERFORMANCE CHARACTERISTICS AND SPECIFICATIONS OF RADIO EQUIPMENT INSTALLED IN GERMAN AIRCRAFT FOR DIRECTION FINDING, BLIND LANDING, BLIND BOMBING AND HEIGHT FINDING—continued

NOMEN- CLATURE	FREQUENCY RANGE (mcs) a. Send b. Receive c. Crystal	TYPE OF SIGNAL RANGE IN MILES	CIRCUIT AND TUBES (a) Send (b) Receive	POWER OUTPUT (watts)	POWER SUPPLY & CONSUMPTION (a) Send (b) Receive	TYPE OF AERIAL	DIMENSIONS AND WEIGHT	ALLOCATION	REMARKS
Navigation Receiver <i>FU 2 EB12.</i>	b. 38		b. 5NF 2 TRF		b. Dynamotor U-8	Dipole under fusel- age.			For blind landings.
<i>X Gerät</i>	b. 66.5-75 (2 on the same range)	Visual Dot-Dash left- right beams.	b. 7 Tube superhetrodyne 20 RV12 P4000		b. Dynamotor	Two vertical $\frac{1}{4}$ wave rods in streamlined hous- ing.		Bomber aircraft.	A special blind bombing device operating on three main beams: one for pilot and two for observ- ers. (Believed to be ob- solete.)
<i>Y Gerät</i> (with <i>FUG 17E</i> and <i>FUG 28A.</i>	a. b. 42.1-47.9	M.C.W. R/T R/T 250	a. 2 RL P35,-13,RV12 b. P4000	10	a. Dynamotor U-17	Vertical rod above and retractable antennae below fuselage.		Bomber aircraft.	A later development than the <i>X-Gerät</i> employing one instead of three beams.
Radio-Altimeter <i>FUG 101-101A.</i>	a. 351-389 b. (Operating Frequency) 370	F.M.C.W. 0-150 meters 100-1500 meters	a. 1, LD 2-1, RV 12 P2001 b. 1, LV5-6, RV12 P2001		a. Dynamotor U-101 b.	Two separate $\frac{1}{2}$ wave dipoles hor- izontally polar- ized: one each for transmitter and receiver.		Multi-engined aircraft for height finding.	
Radio Altimeters <i>FUG 103.</i>	a. 370 b.								An improvement on <i>FUG 101</i> and <i>101A</i> . Does not interfere with other wire- less equipment on board.

Figure 58 (Continued).

UNCLASSIFIED

GERMAN CABLES

Description	Conductor Strands	Insulation Material	Outside Diameter	Estimated Talking Range (Mls.)	Weight (Lbs. per 1,000 Feet)	Tensile Strength (Lbs.)	Insulation Abrasion Resistance	D-C Resistance Single Conductor per 1,000 Feet	Attenuation at 1,000 CPS. db. per Mile
Two-conductor cable with black rubber jacket applied over one white and one black rubber-insulated conductor.	0.024-inch solid copper.	Rubber type.	0.115-inch (single-conductor).	Dry, 16.3; wet, 10.1.	20.5	275	High.	25.9	Dry, 1.84; wet, 2.97.
Twisted-pair field wire, each conductor of which has a black braid over a white rubber insulation.	6, 0.013-inch steel; 2, 0.013-inch copper; 1, 0.021-inch copper.	Rubber type.	0.128-inch.	10.3 (2-wire metallic circuit).	12.9	400	Very high.	11.6	2.91
Single-conductor field wire with a stiff red synthetic insulation over 8 steel and 1 copper strands.	8, 0.015-inch steel; 1, 0.028-inch copper.	Polyvinyl, Chloride type.	0.135-inch.	.....	....	400	Very high.	11.6	
Single-conductor field wire with a wax-impregnated cotton braid over a black rubber insulation. The conductor consisting of 8 steel, and 1 copper, strands.	8, 0.015-inch steel; 1, 0.028-inch copper.	Rubber type.	0.128-inch.	8.5 (2-wire metallic circuit).	11.8	400	Very high.	16.9	3.53
Single-conductor field wire with a stiff red synthetic insulation and a conductor consisting of 8 steel and 1 aluminum strands.	8, 0.015-inch steel; 1, 0.028-inch aluminum.	Polyvinyl, Chloride type.	0.130-inch.	4.9 (2-wire metallic circuit).	9.2	...	High.	51.4	6.12
Single-conductor assault wire with a yellow synthetic insulation over a conductor consisting of 7 aluminum strands.	7, 0.016-inch aluminum.	Polyvinyl, Chloride type.	0.055-inch.	.....	2.5	...	.....	83.5	
Single-conductor assault wire with a cotton braid over a blue cellophane insulation. The conductor has 6 steel and 1 copper strands.	6, 0.008-inch steel; 1, 0.010-inch copper.	Cellophane type material.	0.425-inch.	Dry, 25.6; wet, 25.6 (not loaded). Voice frequency.	127	510	.....	3.52	Dry, 1.17; wet, 1.17.
Long range field cable having four rubber-insulated conductors spirally twisted about a rubber-covered synthetic core. Over this quad is placed a tinsel shielding tape and a black rubber jacket.	19, 0.0125-inch copper.	Rubber type insulation and jacket.							
108-conductor cable composed of 12 tinned copper strands. Insulation of cotton covered with impregnated cotton tape and rubber outer jacket.	12 copper .....	.....	0.875-inch.		525	...	.....

Figure 59.

1 MARCH 1945

TM-E 30-451

DESCRIPTION OF EQUIPMENT USED IN THE GERMAN ARMY FOR TESTING RADIO SETS

NOMENCLATURE	DIMENSIONS AND WEIGHT	DESCRIPTION	REMARKS
Wavemeter <i>Fremes a.</i>	17½"x14"x10"—46 lbs.	Frequency range: —30 kcs —30 mcs in 20 switched bands. Facilities: will emit modulated or unmodulated signal. (Loose or tight coupling to receiver.) Circuit as receiver: RF-oscillating detector—2AF RES 094. RE134W; RE. 134 Circuit as sender: oscillator—anode modulator. Power supply: 4-volt storage battery. 3-volt grid bias, 150-volt H.T. batteries.	The outstanding feature in the construction of the wavemeter is the massive turret for waveband switching, which takes up most of the space inside the case.
Frequency Tester <i>F. prüf. dl.</i>	—29 lbs.	Frequency range —120 —156 mc (26 fixed frequencies). Power supply: storage battery 2 N/9 and one 90-volt H.T. Battery.	For frequency calibration of fixed sets within its range.
Field Test Set 18 (<i>Das Feldmesskasten</i>)	6.3"x4.7"x2.9"—2¾ lbs.	A field test set similar to the U. S. army's EE65.	A general purpose field Test Set.
Attenuation Meter.—39 (<i>Dämpfungsmesser</i> 39)	13¼"x10¼"x9½"—	Is capable of measuring the amplification (in nepers) of 2 and 4 wire repeaters and the attenuation at 300 cycles over any type of line. Can measure crosstalk attenuation between the lines. Is powered with 90-volt H.T. battery and a 2-volt 2B19 storage battery.	Used in conjunction with telephone repeaters in testing and adjusting input and output levels.
German Tube Checker (<i>Röhrenprüfgerät</i> <i>RPG4</i>)	16"x15"x9"—30 lbs.	Will test all European and a small number of American tubes. It may be used as a milliammeter, ohmmeter, and capacity meter. Can only be used for DC voltages and currents.	
German Exploring Coil		This apparatus can be used to locate grounds, shorts, crosses and wet spots in cables. (However, it will not locate "opens" in cable pairs.)	
German Frequency Test Set <i>F.</i> <i>prüfg. f.</i>	—25 lbs.	Crystal controlled oscillator fundamental output frequency of 26 mcs. Power supply: 2.4-volt storage battery for vibrator, one tube RL2 4T1. Consumption: 2.42 @ 6 amperes.	A field pack servicing and calibration unit for the <i>Feldfu. b</i> and <i>c.</i>

Figure 60.

Section V. ENGINEER EQUIPMENT

1. Instruments

a. GENERAL. In general the instruments used in the field by the engineers of the German Army are identical with our own, particularly their transits, theodolites, and surveyor's levels. The main differences occur in compasses and gap-measuring instruments.

b. GERMAN FIELD COMPASS (*Marschkompass*).

(1) *Description*. The German field compass is a black, pocket-sized instrument. The housing is of aluminum-like metal. A brass outer ring is attached with a carrying handle. A hinged, linear, centimeter scale unfolds from the base of the compass housing. The letters *MKZ(KZ)* are marked on the body of the compass.

(2) *Operation*. The swinging of the magnetic needle can be stopped by pressing the damper button. When the destination is visible, open the cover and raise the mirror half way, so the magnetic needle can be seen clearly. Sight the point through the rear V sight and the front aperture at the base of the mirror. Hold steady until the point is in line with the eye, then with the free hand turn the azimuth circle until the magnetic needle falls on the magnetic declination mark. Read the azimuth from the dial. The German compass is numbered counter-clockwise, and the graduations are in mils. To simplify compass reading, the dial has been abbreviated so the last two zeros have been omitted; thus, 6,000 mils is shown as 60. The markings for directions are the same as our own, with the exception of East which is marked "O" for *Ost*. The adjustments for magnetic declination are marked directly on the azimuth dial; two luminous dots indicate 150 mils East and West.

c. NEW TYPE FIELD COMPASS (*Marschkompass "A"*). It is now known that a new type compass is in use in the German Army. This compass is numbered clockwise in mils.

d. GAP-MEASURING INSTRUMENT. This is a simple device to measure the width of streams and similar gaps. It is designed on the principle of similar right-angled triangles and consists of two parts: a fixed mirror and a measuring mirror.

2. German Demolition Equipment

a. SAFETY FUZE BLASTING CAP AND ACCESSORIES (*Sprengkapsel No. 8*). (1) *Description*. This blasting cap is similar to the U. S. and British types. It is designed to fit over the

safety fuze and be initiated by it. The initiator of the cap consists of lead azide and lead styphnate.

(2) *Characteristics*.

Length 2.36 inches.

Diameter 0.28 inch.

Packing 15 in wooden box.

(3) *Bakelite Holder (Zünderhälter)*. This holder serves the double purpose of connecting the cap and fuze and permitting the cap to be screwed into the charge. It consists of a tube which covers the junction of the cap and fuze, and is enclosed in a bakelite cover. At one end of this cover is an externally threaded sleeve; the other end is covered by a bakelite cap with a central hole for passage of the fuze.

(4) *Blasting Cap Igniter Set (Sprengkapsel-zünder)*. This is a prepared set with a cap in a bakelite holder, with a 3- to 6-foot safety fuze attached, and a safety fuze igniter. This provides a convenient short-delay demolition igniter.

b. SAFETY FUZE (*Zeitzündschnur*). The black powder train of this fuze is enclosed in strands of jute-like fibre and white cotton-like fibre alternately, the whole being covered with a bituminous paint, over which goes the black rubber outer covering. This safety fuze burns in air or under water at the rate of approximately 2 feet a minute. It can be initiated in the same way as U. S. and British safety fuzes.

c. ELECTRIC BLASTING CAPS. (1) *Glühzünder 28*. This consists of a cap, with twin leads of copper or iron, and a wire bridge. The whole fits into a standard bakelite cap holder. The copper leads have a resistance of 2 ohms; iron, 3 ohms.

(2) *Delay Electric Blasting Cap (Glühzünder mit Verzögerung)*. These electric caps, which fire with a delay of 2, 4, 6, 8, or 10 seconds after electrical initiation, are similar to ordinary electric caps except that there is a pyrotechnic delay pellet between the wire bridge and the cap proper. These caps have the number of seconds delay marked on a disc attached to the leads.

(3) *Spark Gap Electric Blasting Cap (Spaltzünder)*. In these caps, the wire bridge has been replaced by a spark gap.

d. INSTANTANEOUS FUZE (*Knallzündschur*). This fuze has a soft, pliable, green, outer covering with a waterproof varnish finish, surrounding an explosive core. It will detonate under water, initiated by a cap, but the ends must be waterproofed.

e. 100-GRAM CARTRIDGE (*Bohrpatrone 28*). There are two types of this cartridge; one in waxed paper, and one in compressed paper. Both cartridges may be marked *Bohr-Patr. 28*, identifying the cartridge, and *Fp.02* or *Grf.88*, identifying the explosive as TNT or picric acid.

f. 200-GRAM SLAB (*Sprengkoerper 38*). This slab is provided in two forms: in waxed paper and in a bakelite case. The waxed paper slab may contain either TNT or picric acid. Pressed picric acid is contained in the casing of two bakelite mouldings. The bakelite slab actually weighs 250 grams or 8¾ ounces.

g. 1-KILOGRAM (2.2 POUNDS) SLAB (*Sprengbüchse 24*). (1) *Description*. This slab may be made either of TNT or picric acid, in a pressure-resisting zinc container which permits it to be used at any depth of water. There are three sockets for standard caps and holders, or igniters—one on each face of the slab, excluding the base. Each socket is covered with a paper disc marked *Sprengbüchse 24* and either *Fp.02* (TNT) or *Grf.88* (picric acid).

(2) *Characteristics*.

Weight2.2 pounds.
Length7.9 inches.
Width2.9 inches.
Thickness2.2 inches.

h. 3-KILOGRAM (6.6 POUNDS) SLAB (*Geballte Ladung 3 Kg.*). (1) *Description*. This slab, in a zinc container with a carrying handle at one end, has either three or five sockets for standard caps and holders or igniters. The container is pressure-resisting, and the slab may be used under any depth of water. This slab is often used with igniters for improvised mines. It is marked 3 Kg. on the side.

(2) *Characteristics*.

Weight6.6 pounds.
Height7.7 inches.
Width6.5 inches.
Thickness3 inches.

i. 3-KILOGRAM BALL CHARGE. (1) *Description*. The spherical body of the charge is constructed in two hemispherical sections of pressed mild steel, seamed together by a rolled joint. The securing lugs are welded to the top half of the body, and to them are attached the two ends of a canvas carrying strap. The charge has the standard threaded igniter socket and is marked 3 Kg.

(2) *Characteristics*.

Weight of explosive6.6 pounds.
Diameter6.25 inches.
FillingAmatol.

j. HOLLOW DEMOLITION CHARGE (400 GRAMS OR 14 OUNCES). This charge is a cup-shaped, aluminum case, painted field gray, with the standard threaded cap socket in the top. A plate is recessed into the base. The central part of this plate forms a hemispherical wall surrounding the hollow space in the base of the charge. The main filling is penthrine.

k. 12.5-KILOGRAM HOLLOW CHARGE (*Hohlladung*). (1) *Description*. This charge is designed to blast holes in steel plates in permanent fortifications or for special tasks. It is enclosed in a sheet iron cover with a carrying handle. In the base of the charge is a hemispherical cavity, and in the top is a standard threaded cap socket. This charge is usually part of the equipment of airborne troops.

(2) *Characteristics*.

Outside diameter11 inches.
Diameter of cavity5.3 inches.
Weight28 pounds.
FillingTNT.

l. 13.5-KILOGRAM HOLLOW CHARGE (*Hohlladung*). (1) *Description*. This hollow charge rests on three telescopic legs, which ensure proper "stand-off". The charge is provided with a pellet contained in a standard detonator socket.

(2) *Characteristics*.

Outside diameter13½ inches.
Diameter of cavity9¾ inches.
Weight of charge30 pounds.
Filling (RDX-TNT)21 pounds.

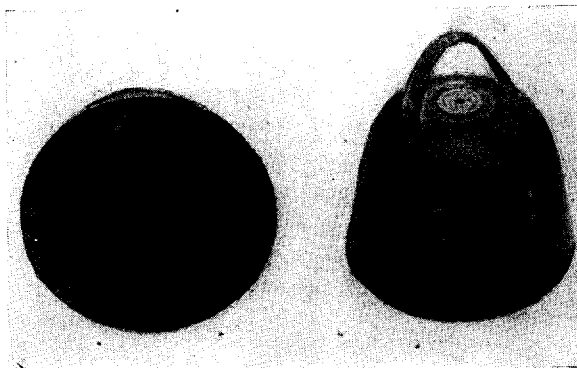


Figure 61.—Hohlladung 12.5-kg Demolition Charge.

m. 50-KILOGRAM HOLLOW CHARGE (*Hohlladung*). (1) *Description*. For convenience in

transport, this charge is made in two parts. The lower part, which is provided with a separate carrying handle, contains a hemispherical cavity. The upper part contains both an explosive charge and a standard cap socket. This charge is part of the equipment of airborne troops.

(2) *Characteristics.*

Outside diameter20 inches.

Diameter of cavity8 inches.

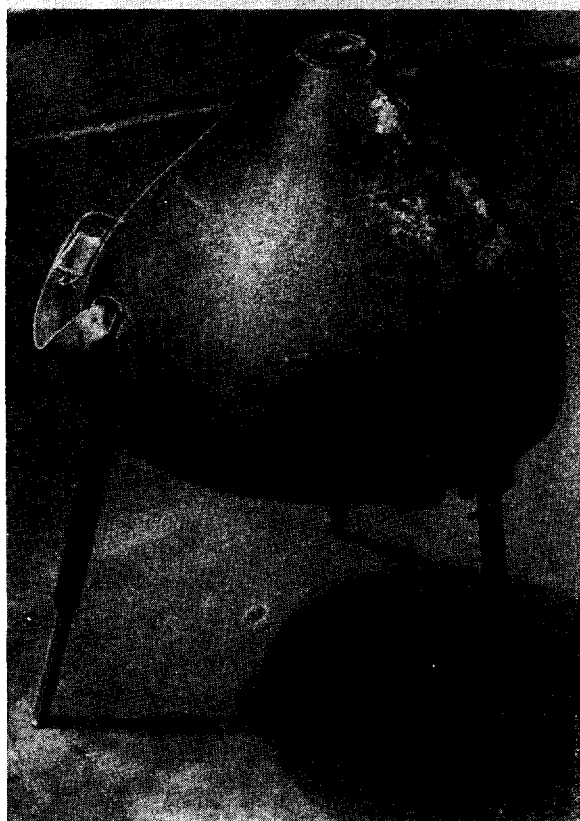
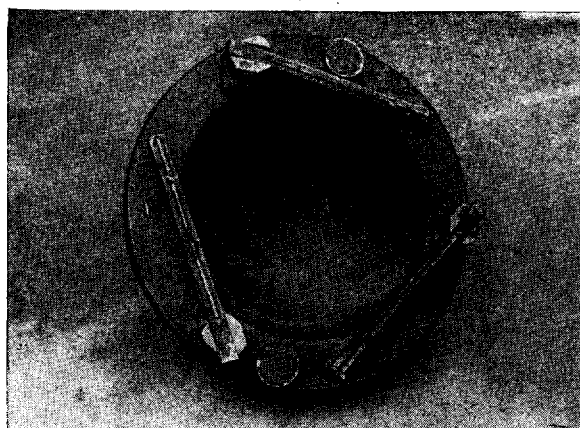


Figure 62.—Hohlladung 13.5-kg Demolition Charge (Top: showing hemispherical cavity and stand-off legs in collapsed position. Bottom: in firing position).

Height of cavity4 inches.
Weight of charge110 pounds.
FillingTNT.

n. HOLLOW RING CHARGES (*Hohlringladung*).

(1) *Description.* These charges, used principally for the destruction of gun barrels, contain TNT, in a thin annular metal casing which is slipped over the gun barrel and fired by a cap. There is an annular, hollow space of semi-circular cross section on the inside of the ring, designed to increase the cutting effect. The fragmentation effect of these charges is negligible, which makes them suitable for use by raiding parties and patrols.

(2) *Characteristics.*

Hollow ring charge for antitank and machine-gun barrels:

Weight2 pounds 11 ounces.

Outside diameter7.1 inches.

Inside diameter3.9 inches.

Width3.1 inches.

Hollow ring charge for field guns:

Weight7 pounds 1 ounce.

Outside diameter10.4 inches.

Inside diameter6.7 inches.

Width3.4 inches.



Figure 63.—Shaped Demolition Charge (50 kg).

o. BANGALORE TORPEDO (*Gestreckte Ladung*).

This torpedo is made up of units of 16-gauge steel pipe lengths, with a sleeve welded to one end to form a socket for the adjoining unit. Units are packed with blasting gelatine or other suitable explosives. Detonating fuzes run the lengths of the tubes. The torpedo is initiated at one end by two independent caps, using a cap igniter set

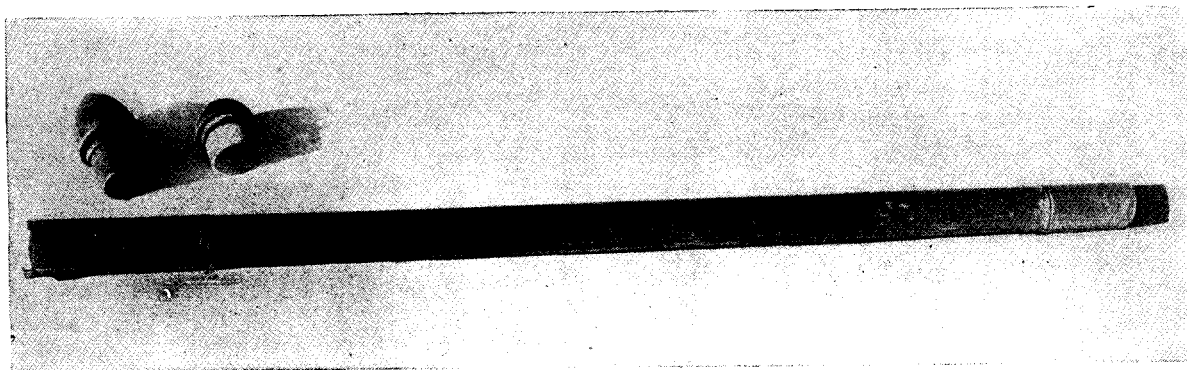


Figure 64.—Bangalore torpedo.

for one and a length of safety fuze and match for the other. Other sections carry a cap fitted to the end of the tube. When assembling sections, the free end of the fuze at the socket end of one section is tied to the cap at the spigot end of the next section.

p. GERMAN FIELD EXPLODERS. (1) *Exploder 1942, six-barrelled (Nebelwerfer)*. This exploder is 6 inches high and has two sockets in the core. One socket is for winding, and the other for a seven-pin plug providing six circuits with a common central return. On the outside of each of the six outer plug holes are six numbered windows which glow in turn as their circuit is completed. The exploder thus can fire six circuits rapidly, one after another; the operator can see the glow lamps recording the firing in succession. Since this exploder has a low capacity, with 20 detonators the maximum number it will handle, its use for demolitions is restricted.

(2) *Small Exploder 1940 (Glühzündapparat 40)*. This exploder forms part of the portable demolition kit (*Zündgerät 40*). It is 5.3 inches high and has an oval-shaped top, mounting the firing terminals and the winding socket. It will fire through 90 ohms external resistance, and the generator is turned directly by the handle in the winding socket. Only when the maximum current is generated is the circuit closed; for firing, the handle must be turned as fast as possible to the "stop". The exploder has an internal resistance of 30 ohms and generates a current of 1 ampere at 80 volts. Before using the exploder, it must be tested with a special neon test tube, which not only tests the exploder but also excites the magnetism in the generator.



Figure 65.—Exploder 43 (6-barrelled).



Figure 66.—Exploder 39 (Glühzündapparat 39).

(3) *Field Exploder 1939 (Glühzündapparat 39)*. This exploder is packed in a leather carrying case. It fires through a maximum resistance of 300 ohms and has an internal resistance of 40 ohms. The winding key is kept in the carrying case, which also holds the test resistance, a spare spring, and a screw driver. On the top of the exploder are the winding socket, the spring socket, and the spring terminals.

(4) *Field Exploder 1937 (Glühzündapparat 37)*. This exploder generates 300 volts and fires through a maximum resistance of 300 ohms. The internal resistance is 43 ohms. The exploder has a winding key kept in the carrying case, which also holds the test resistance. On top of the exploder is a winding socket marked *Aufziehen* and a firing socket marked *Zünden*. The firing terminals are on an insulated step below the level of the cover. The spring driving the generator cannot be released unless it has been fully wound. To use the exploder, wind the spring clockwise until the "stop" is reached. To fire, turn the socket marked "Zünden" with the key.

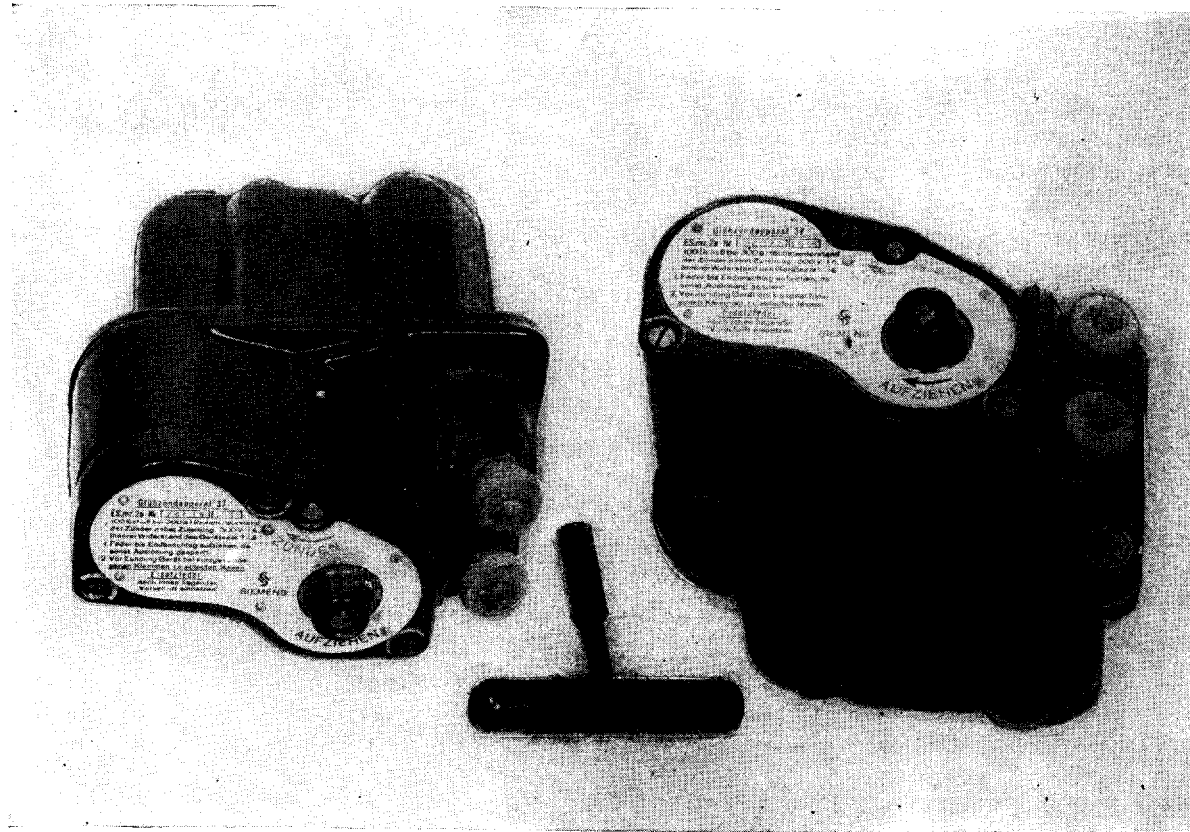


Figure 67.—Exploder 37 (Glühzündapparat 37).

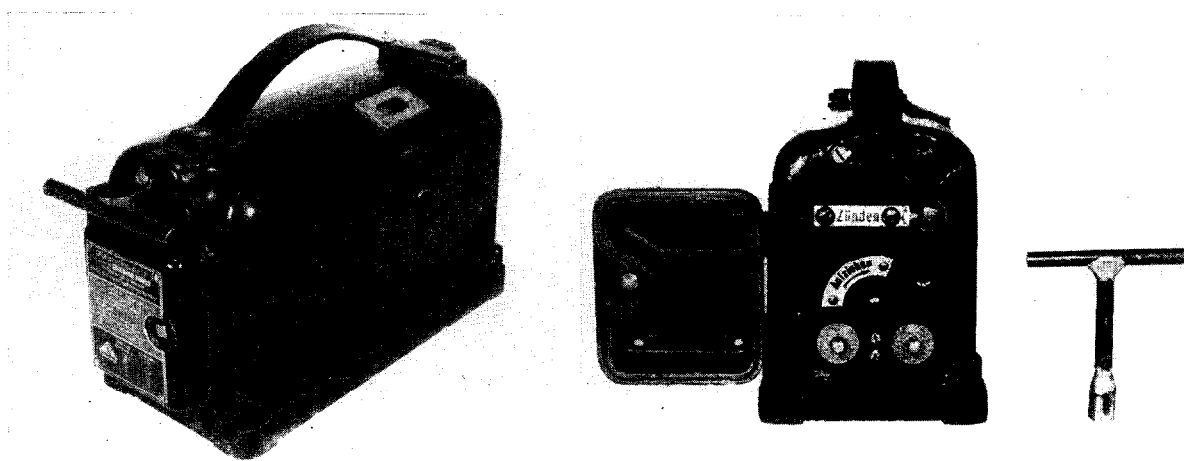


Figure 68.—Exploder 26 (Glühzündapparat 26).

(5) *Field Exploder 1926.* This exploder weighs 14.5 pounds and is packed in a leather case. The exploder is of the low tension type (hot wire as opposed to spark) with an internal resistance of 45 ohms. Maximum resistance through which it will fire is 255 ohms.

q. *PORTABLE DEMOLITION KIT 1940.* This is a pack containing everything needed to fire charges electrically. It weighs 51 pounds, and can be carried by a handle or by shoulder straps on the back. It contains a small exploder (1940) and neon test tube, a continuity tester (galvanometer) (1926), 40 electric detonators, two spools of single cable and two drums of double cable, metal sleeve for crimping over electrical joints, a notched pocket knife, crimpers, and insulating tape.

r. *CONTINUITY TEST (GALVANOMETER) 1926.* This tester not only tests continuity but also measures resistance of circuits and detonators. It contains an ohmeter, resistance, and battery (1.5 volts). The battery is housed in a cylinder 4.7 inches high with the ohmeter on top. Adjusting screws for setting the ohmeter needle to zero and infinity are midway between the testing terminals. A built-in resistance protects caps from being initiated while being tested for continuity.

s. *TEST RESISTANCE AND NEON LAMPS.* The resistance is for testing the Field Exploder 1926 for firing through 250 ohms resistance. The neon lamp, designed for testing the Field Exploder 1937 and 1939, has a screw head which may be set to test for firing either 50 or 100 detonators. There is another neon lamp for

testing the small Exploder 1940. It is part of the portable Demolition Kit 1940.

t. *MAGNETIC DEMOLITION CHARGE ANTITANK (Panzerhandmine).* This charge is spherical and completely covered by pressed cardboard. This cardboard casing, held in shape by two metal bands, extends 4 inches below the base of the explosive. Primarily designed as a demolition charge, it also can be used against tanks. The explosive filler is 1 pound 12 ounces of cyclonite and TNT. The booster consists of two pellets of cyclonite and wax in which there is a fitting for a standard igniter of the BZ type.



Figure 69.—Resistance and neon test lamp.

11. GERMAN ANTITANK MAGNETIC HOLLOW CHARGE. This charge is painted field gray. The three attached magnets are strong enough to hold the charge against a vertical surface. The main filling is in a pressed metal container, conical in shape, with an elongated apex to act as a hand grip and to accommodate the detonator. The igniter has a delay of only $4\frac{1}{2}$ seconds. However, a new type igniter with a yellow head and a $7\frac{1}{2}$ -second delay has been introduced.

3. Booby Traps

a. MATERIALS. The following standard materials have been used in German booby traps:

- Tellermine.
- S-Mines.
- C.V.P.I. Mines.
- Improvised wooden mines.
- Prepared charges.
- Mortar bombs.
- Hand grenades.
- Italian B.4 mines.
- Italian hand grenades.
- French antitank mines.
- British G.S. mines Mks. II, IV, and V.
- British gun cotton slabs.
- British aircraft bombs.

b. METHODS OF SETTING. The booby traps are set ordinarily in the following ways:

Tellermine with anti-lifting devices.

Tellermine connected by prima cord to two or more E.P. mines and fitted with an anti-lifting device.

S-Mines with pull igniters.

C.V.P.I. mines with setting at "K" and a trip or pull wire.

Prepared charges, concealed in rubbish, fitted with pull igniters and pull wires.

Charges inside a water bottle fitted with a pull igniter to detonate on the withdrawal of the cork.

Mortar bombs fitted with S.Mi.Z.35 igniter.

Egg and stick grenades fitted with pull igniters.

Italian B.4 mines with trip wires.

French antitank mines with pull igniters.

British aircraft bombs with pull igniters and trip wires.

Empty German mine cases with pull igniters attached to the bottom of the crate or inside of the lid.

c. EMPLOYMENT IN BUILDINGS. Pull igniters inserted in prepared charges, grenades, and standard mines commonly are used as booby traps in buildings. The friction igniter ZDSCHN. ANZ.

29, attached to a prepared detonator, also is used with a pull cord. The trip or pull wires may be laid across entrances and doorways, across stairways, or attached to doors of rooms, cupboards, or to windows. Both ends of wires should be investigated for traps. If wires are in tension, they must not be cut until this investigation has been carried out. Pressure igniters commonly are found under loose boards and door mats. The DZ.35 type is the igniter usually employed.

4. German Mine Detectors

a. MINE DETECTING ROD, 1939 PATTERN. (1)

Description. This detector consists of a length of light alloy tubing, one end of which carries a steel point, while the other carries a bayonet joint permitting a second length of tubing to be added when the operator is standing. The weight of the main tube and point is approximately 10 ounces.

(2) *Employment.* This detector is used as a probe, the point being dropped vertically into the ground from a height of about 4 inches. It is claimed that the nature of any underground object encountered can be recognized by the characteristic sound coming from the tube.

b. MINE DETECTOR BERLIN 40 TYPE B.

(1) *Description.* This detector consists of a detector unit carried in a pack on the operator's back, a search coil, sectionalized pole, headphones, and cable connections.

(2) *Employment.* The variable condenser is adjusted to produce a suitable note in the earphones. Proximity of a metal object to the search coil produces a change of tone.

c. MINE DETECTOR Tempelhof 41. (1) *Description.* This is a portable detector provided with a loud speaker instead of earphones. The whole instrument can be carried in an infantry pack.

(2) *Employment.* The tone control is turned to the right until the loudspeaker produces its maximum volume. In presence of a metal object the tone will rise in pitch.

d. MINE DETECTOR Frankfurt 40. (1) *Description.*

This detector is contained in a wooden box which fits into a canvas pack. The pack also has a compartment in which the search coil can be carried when not in use. The box is divided into two compartments, one for the batteries and one for the detector. The wiring is exposed by removal of a sliding panel which is held in position by one screw. The tubes and batteries are acces-

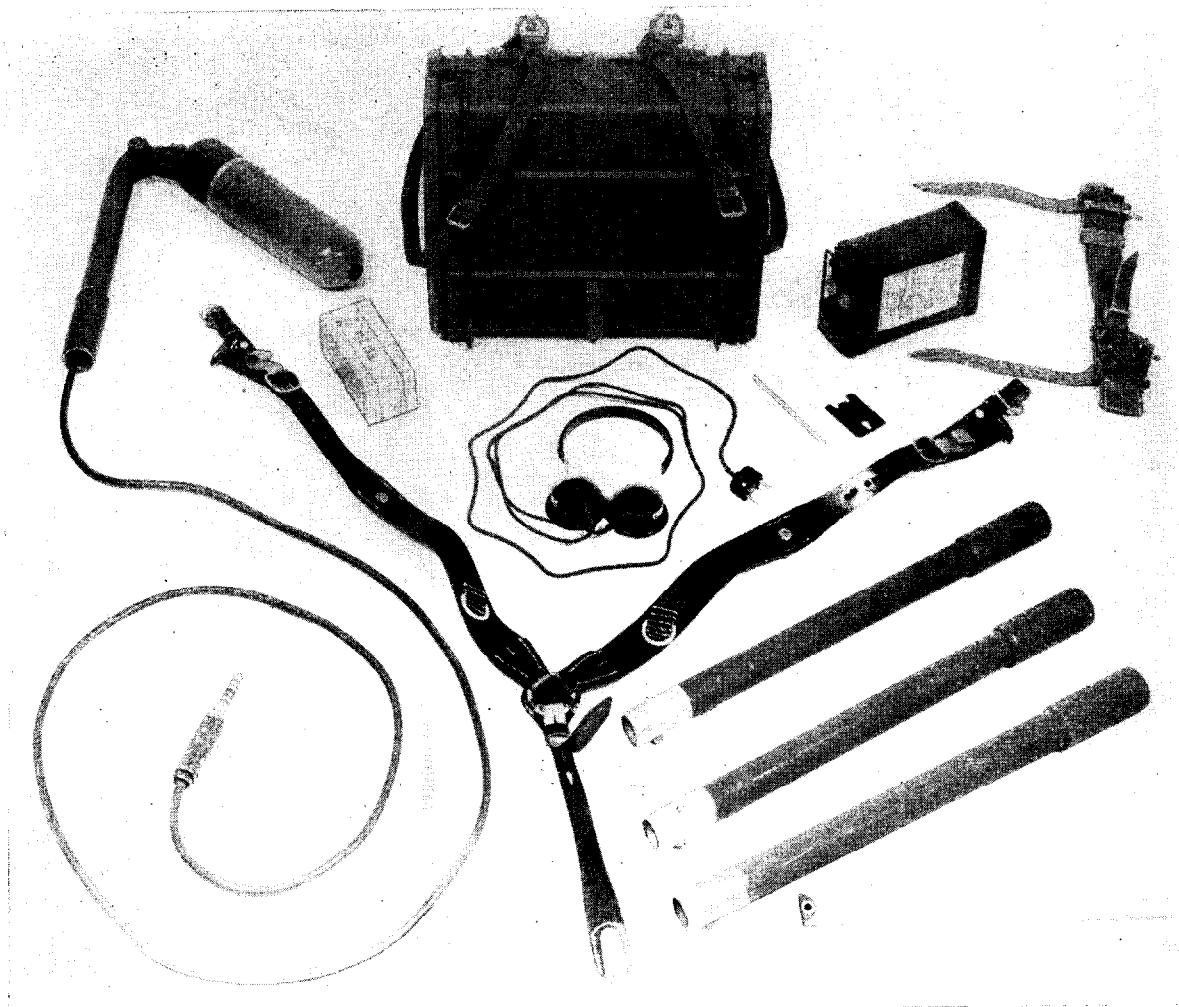


Figure 70.—Mine Detector (Wien 41).

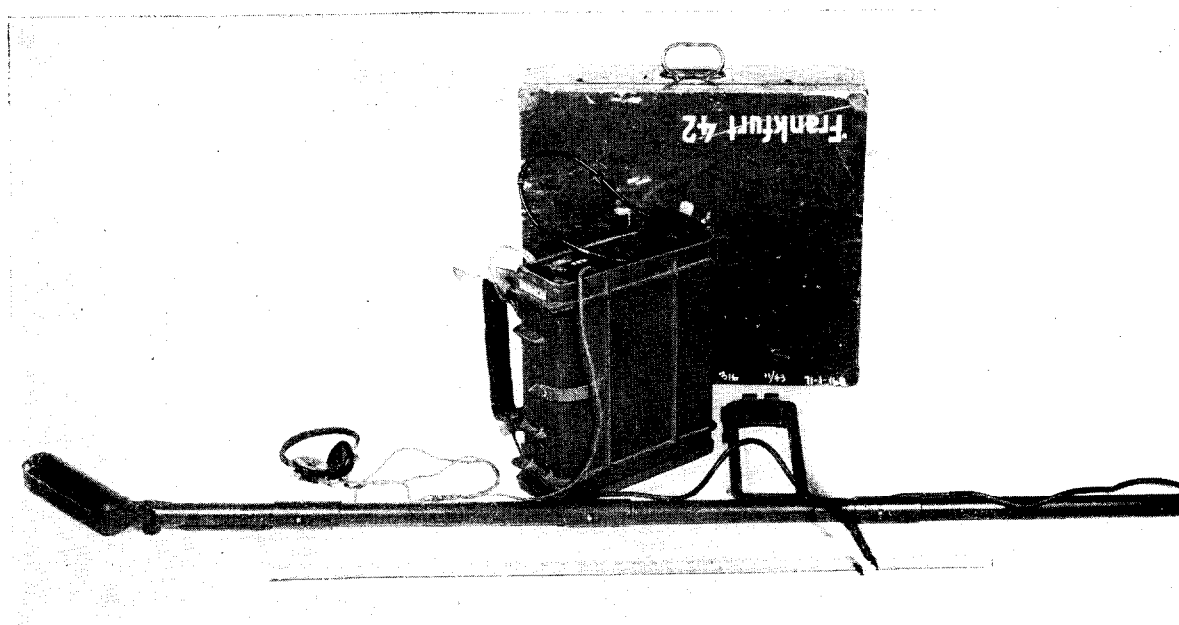


Figure 71.—Mine Detector (Frankfurt 42).

sible after removal of the front panel. The pole is in three sections. The search coil is housed in a bakelite moulding.

(2) *Employment.* The circuit is adjusted for zero balance. A tone is produced in the earphones by proximity of a metal object.

e. OTHER MINE DETECTORS. Other mine detectors in general use are:

Pentagrid tube type.

M.S.F. 1007.

Frankfurt 42.

Pram Mine Detector.

Wiesbaden Mine Detector.

5. Antipersonnel Mines

a. S-MINE 35. (1) *Description.* This antipersonnel mine may be operated by direct pressure on an igniter in the head, or by a pull on one or more trip wires attached to pull igniters. The mine may also be fired electrically. The pressure igniter, *S.Mi.Z.35*, functions under a weight of about 15 pounds. When set with trip wires, pull igniters *ZZ.35* or *Zu.ZZ.35* are used, with a two- or three-way adapter screwed on the mine in place of the transit cap. The mine is cylindrical with a close-fitting cover. For transport three are carried in a wooden box or watertight pressed metal case. In the space between the outer case and inner cylinder of each mine there are approximately 360 steel balls, mild steel rods in short lengths, or small pieces of scrap steel. These constitute the loading of the mine. The base plate has a recess to hold the propellant charge. The central steel tube is threaded externally to take the adapters or igniters, and internally to take any standard German igniter or electric detonator for deliberate firing. At its lower end, the tube passes through the base plate and is secured by a union. Inside the main steel tube is another short tube, containing a delay element (about $4\frac{1}{2}$ seconds). There have been cases where the delay holder has been replaced by a detonator, causing the mine to explode without jumping. Equally spaced in the base plate are holes leading into the bottom of the three detonator tubes and containing short-delay elements. When the igniter functions, the delay pellet provides a short delay before igniting the propellant charge in the base of the mine. The burning of this charge projects the main elements of the mine into the air. Simultaneously, the powder delays in the bottom of the detonator tubes are ignited and explode the mine some 3 to 5 feet above the ground.



Figure 72.—S-Mine with Y Adapter and Z.Z. 35 Igniter.



Figure 73.—S-Mine with S. Mi.Z. 35 Igniter.

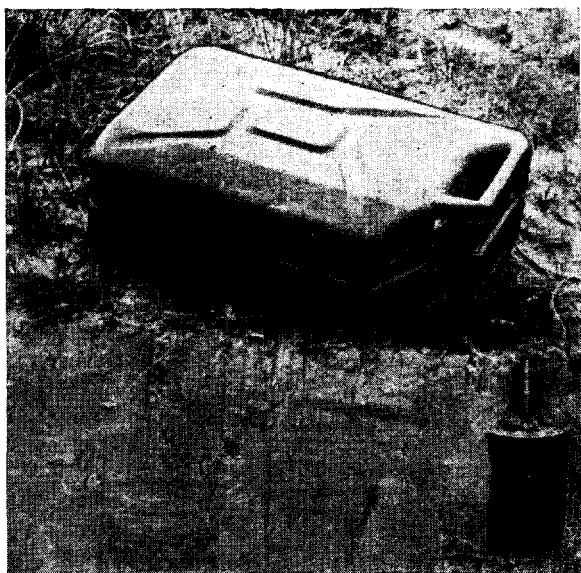


Figure 74.—Jerrican booby-trapped to S-Mine.

(2) *Characteristics.*

Height (less igniter)5 inches.
 Diameter4 inches.
 Weight9 pounds.
 Weight of filling:
 Poured TNT14 ounces.
 Powdered TNT8 ounces.

(3) *Performance.* The delay between firing the igniter and the ejection of the mine varies according to age and condition of the mine. However, tests have shown an average of 3.9 seconds. The delay between the ejection of the mine and the detonation also varies; tests have shown that it averages 0.6 second.

(4) *Neutralization.* Anti-handling devices first are neutralized. Then uncover the mine, identify, and neutralize the igniters.

(5) *Disarming.* After neutralizing, cut the trip wires of the pull igniters. Unscrew the igniters and unscrew the plugs from the three holes in the cover and remove the detonator by turning the mine over.

b. S-MINE 44. (1) *Description.* The S-Mine 44 is an antipersonnel mine of the bounding type similar to the S-mine 35. The igniter well is toward one side of the cover plate, and the height at which the mine explodes is controlled by an internal pull-igniter arrangement. The igniter is the combination push-and-pull type, and its neutralization demands extreme care. The employment of this mine is the same as for the S-mine 35. The lethal range is 22 yards, and the casualty range 110 yards.

(2) *Operation.* The igniter initiates the 4½-second delay pellet firing the propellant, which throws the mine upward. When the coiled wire is fully extended it pulls the release pin from the igniter, exploding the mine.

c. *Schü-Mine 12.* (1) *Description.* The *Schü-mine 12* with the *Z.Z. 12* igniter is an easy, handy obstacle to employ against infantry, cavalry, and light vehicles. In small-scale obstacles, it conveniently can be substituted for the S-mine 35. In almost all minefields it can be used in conjunction with Tellermine. The mine consists of a casing of impregnated plywood, or hardened compressed fibrous cardboard, painted dull black; one 1928 pattern demolition charge weighing 200 grams or 7 ounces; and one *Z.Z. 12* pull igniter with No. 8 detonator. The total weight is 1.1 pounds. The igniter is prepared for use by unscrewing the safety cap and inserting the detonator (open end to open end). The pin is held in position by the spring loaded striker.

(2) *Lifting and Neutralizing.* After locating the mine, search for and neutralize any anti-handling devices, then lift the lid without exerting any pressure. See whether the pin of the igniter is still seated firmly in the striker. If this is the case the mine may be lifted, after determining that there are no anti-lifting devices. Mines on which pressure has been exerted and the pin disturbed from its normal position should be destroyed in place.

d. WOODEN ANTIPERSONNEL MINE 43(N).

(1) *Description.* In its operation this mine, with an impregnated wood body, is very similar to the standard German *Schü mine 12*. The lid, hinged to the back of the body, is fitted with a metal operating flange at the front. This flange, in the armed position, rests on two wooden dowels and is secured by a safety pin. The center of the flange is slotted to clear the striker of the igniter, but two small tongues rest in the loop of the igniter pin. The igniter, *Z.Z. 12*, is screwed into a zinc socket. The main filling is cast TNT, with pressed TNT around the detonator socket.

(2) *Characteristics.*

Length8½ inches.
 Width6½ inches.
 Height open4½ inches.
 Height closed3½ inches.
 Weight of filling3 pounds 5 ounces.

(3) *Operation.* The mine is fired by pressure on the lid. The metal flange will first shear the dowels and then push out the pin, thus releasing

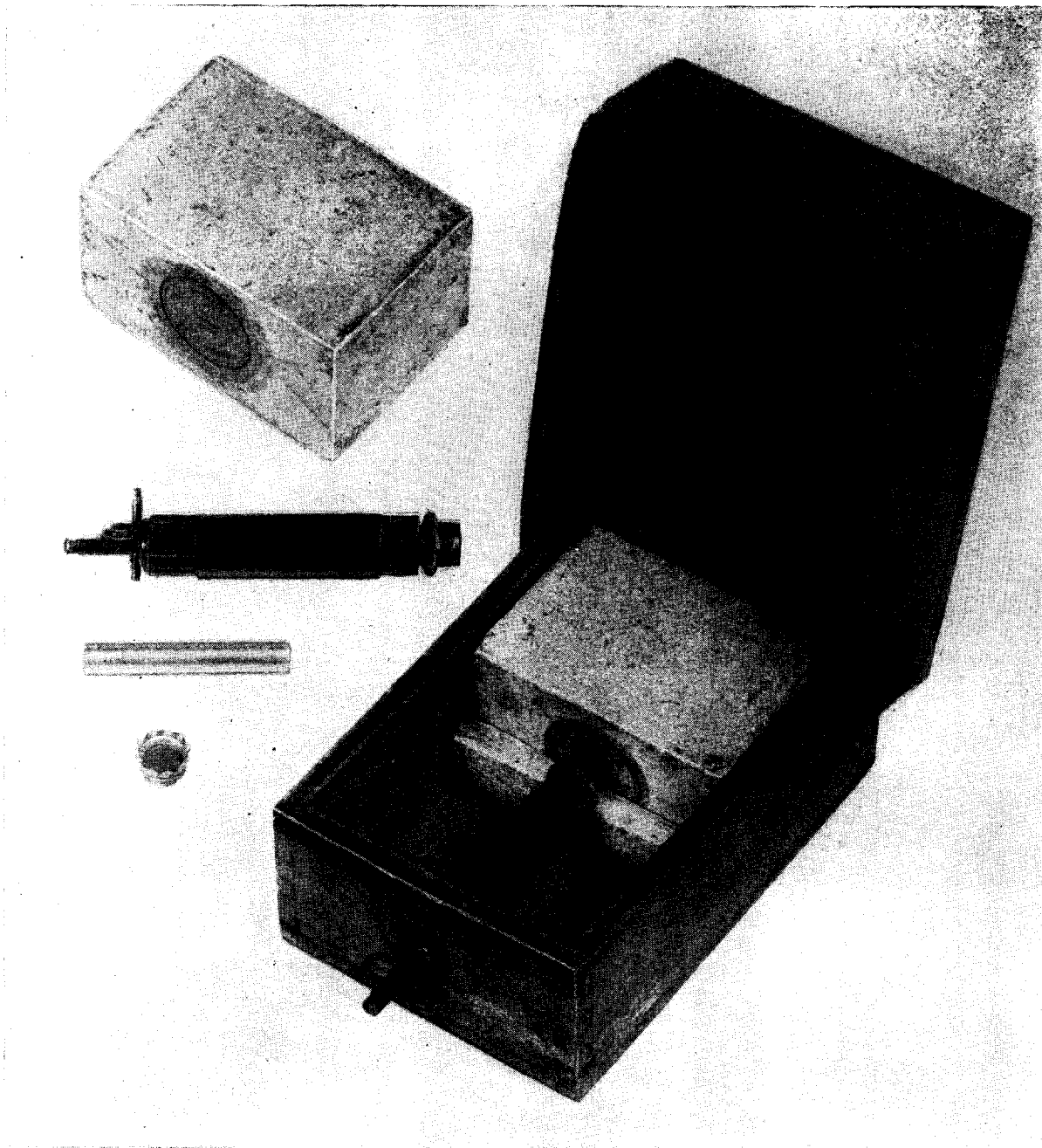


Figure 75.—Schü-Mine with Z.Z. 42 Igniter.

the striker. The operating load is approximately 75 pounds.

(4) *To Neutralize.* The same as for the Schü-mine 42.

c. WOODEN MINE 42(N). (1) *Description.* The body is made of impregnated wood, with a zinc socket in the top to take a detonator and igniter. Across the top is a shaped block of wood drilled to allow the igniter to be screwed down on the top of the body. The igniter is the stand-

ard D.Z.35. The main filling is cast TNT with pressed TNT primer.

(2) *Characteristics.*

Length	6 $\frac{1}{4}$ inches.
Width	6 $\frac{1}{4}$ inches.
Over-all height	5 $\frac{1}{8}$ inches.
Height of body	2 $\frac{1}{4}$ inches.
Weight of filling	3 pounds 5 ounces.

(3) *Operation.* The mine is fired by pressure on top of the D.Z.35 igniter, or by pressure on a

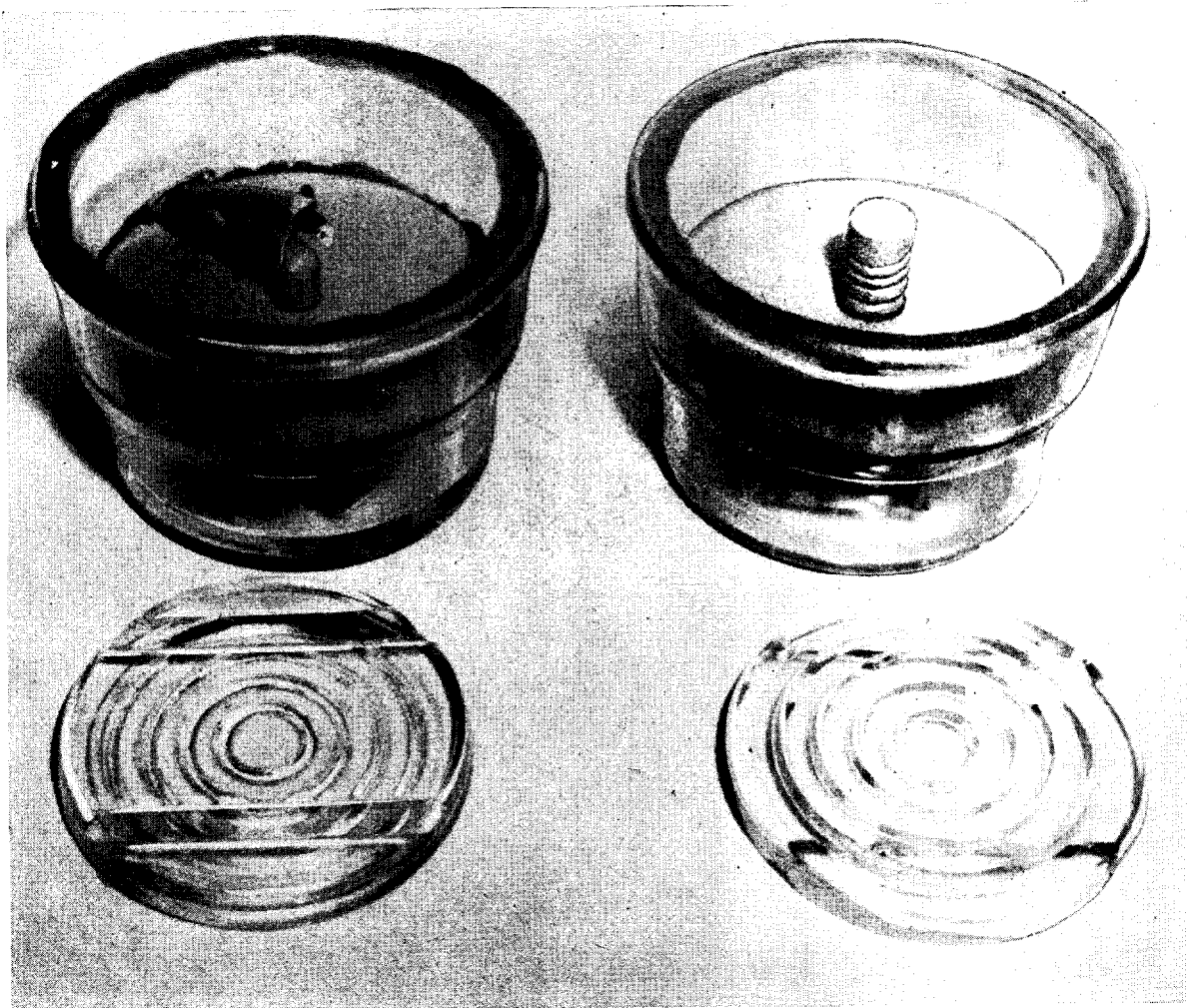


Figure 76.—Glass Mine 43 with (a) Hebelzünder Igniter, and (b) Buck Igniter.

cover board over the head of the igniter. Without the cover board, the mine is practically insensible to blast, but the probability of operating the mine is reduced considerably. The functioning load of the igniter fitted to this mine is 75 pounds. It appears that the igniter is being manufactured with a weaker spring for use in this mine, since the pressure required to function a standard *D.Z.35* is 130 to 165 pounds.

f. ANTIPERSONNEL PRESSURE MINE (ITALIAN). (1) *Description*. This mine consists of a rectangular bakelite box, with a wedge-shaped, hinged lid, containing a TNT charge held in place by a projection and surrounded on the remaining three sides by deeply grooved fragmentation plates. The igniter mechanism consists of a metal tube which contains a spring-loaded striker, fitted with an actuating pin and a cocking ring. The outer end of the striker tube is secured against

the wall of the box by a flange. The striker assembly slips into the side of the mine, in a recess cut out to receive it. A corresponding slot in the lid enables the mine to be completely closed when the igniter is not cocked.

(2) *Characteristics.*

Length of box 5.35 inches.
Width of box 2.56 inches.
Depth of box 1.5 inches.
Length of charge 2.6 inches.
Width of charge 1.97 inches.
Depth of charge 1.18 inches.
Weight of charge 5 1/4 ounces.

(3) *Method of arming.* To arm the mine the igniter is cocked by pulling out the ring and inserting the actuating pin. The detonator is then inserted in the striker tube and secured by locking the ring. The whole assembly is inserted in the box, the detonator fitting into a recess in

the explosive charge. Finally, the lid is gently closed until it rests on the actuating pin.

(4) *Operation*. A slight pressure on the lid will cause it to push out the pin and release the striker.

(5) *To Neutralize*. Avoid all pressure on the lid of the mine. Search for and neutralize any anti-handling devices. Lift the lid clear of the actuating pin. Insert a wire or nail in the safety-pin hole and lift out the striker assembly. Unscrew the locking ring and remove the detonator.

g. ANTIPERSONNEL GLASS MINE 43. (1) *Description*. This antipersonnel mine is made almost entirely of glass. It is armed with the chemical igniter or with the *Hebelzünder*. The bottom of the glass container is recessed to hold a *Sprengkörper 28*. On top of the mine rests a glass shear plate, and, on top of that, a thick glass pressure plate.

(2) *Operation*. A pressure of 20 to 25 pounds breaks the thin shear plate and applies pressure on the lever of the *Hebelzünder*, thus firing the igniter and exploding the mine.

(3) *To Neutralize*. If the mine is fitted with a *Hebelzünder*, remove the two glass plates, insert safety pin, and unscrew the igniter. Then remove the detonator. If it is fitted with a chemical igniter, unscrew the igniter by gripping it as low

as possible. Do not grip the corrugated portion which crushes easily.

h. GERMAN ANTIPERSONNEL "POT MINE".

(1) *Description*. A crush igniter is screwed into the top of the cylindrical body of this mine by means of an adapter. The pressed steel body contains an explosive filling of approximately 4 ounces of powdered picric acid.

(2) *Operation*. A moderate pressure on the top of the igniter explodes the mine.

(3) *To Neutralize*. Unscrew the igniter, grasping it as low as possible. If the detonator does not come out with the igniter, remove it by turning the mine upside down. If it does not then drop out, unscrew the adapter and remove the detonator. The total weight of the mine is 12½ ounces.

i. MODIFIED *Schü-Mine*. (1) *Description*. This modified *Schü-mine* may be used with the Z.Z.35 igniter. The large lid has a sloping front through which the igniter plunger head protrudes.

(2) *Operation*. Pressure on the lid causes the sloping front to push on the actuating pin. This pulls out the plunger of the igniter, causing it to fire. A hole is bored in the lid directly above the safety pin of the igniter. A cord attached to the ring of the safety pin is used to draw the pin out through the hole to arm the mine.

6. Antitank Mines

a. **GENERAL.** The Germans use about 40 types of antitank mines, but the four types of Tellermines are used most extensively.

b. **TELLERMINE 43 (MUSHROOM).** (1) *Description.* In place of the usual cover, this mine has a mushroom head pressure plate which screws into the igniter socket. Two threaded sockets are provided for subsidiary anti-lifting igniters, one in the side of the mine and the other in the base. The positions of these two sockets vary, although they always have been found on a diameter of the mine.

(2) Characteristics.

Diameter over-all12.5 inches.
 Depth of body2.6 inches.
 Maximum height of mine.3.5 inches.
 Diameter of mushroom
 head7.5 inches.
 Depth of mushroom head.1 inch.
 Total weight of mine ...17 pounds 5 ounces.

c. **TELLERMINE 1942 (T.Mi.42)** (1) *Description.* This mine consists of a cylindrical, pressed-steel body, containing a central detonator pocket which is surrounded by a priming cylinder of a composition resembling penthrine. Two pull ig-

niter sockets are provided, one in the side of the mine 4 inches from the carrying handle, and the other in the base 2 inches from the center of the mine. These sockets are screwed into the body of the mine and waterproofed by rubber washers. A cylindrical cavity on the top of the mine contains the pressure-plate assembly. This pressure plate carries a rubber washer or aluminum strip, which is secured to it by a steel ring spot-welded to the plate and forming a seal where it passes under the lower edge of the flanged ring. A strong spring provides the resistance which must be overcome to depress the pressure plate. A central, threaded socket serves for the insertion of the igniter assembly, *T.Mi.Z.42-15*, consisting of a spring-loaded striker retained by a shear pin. The detonator resembles that used in the Tellermine 35, but it screws into the body of the mine.

(2) Characteristics.

Diameter of base12 $\frac{1}{2}$ inches.
 Diameter of case12 $\frac{1}{2}$ inches.
 Diameter of pressure
 plate5 $\frac{3}{4}$ inches.
 Maximum height4 inches.
 Type of fillingTNT.
 Weight of filling12 pounds.
 Weight of mine18 pounds (approximately)

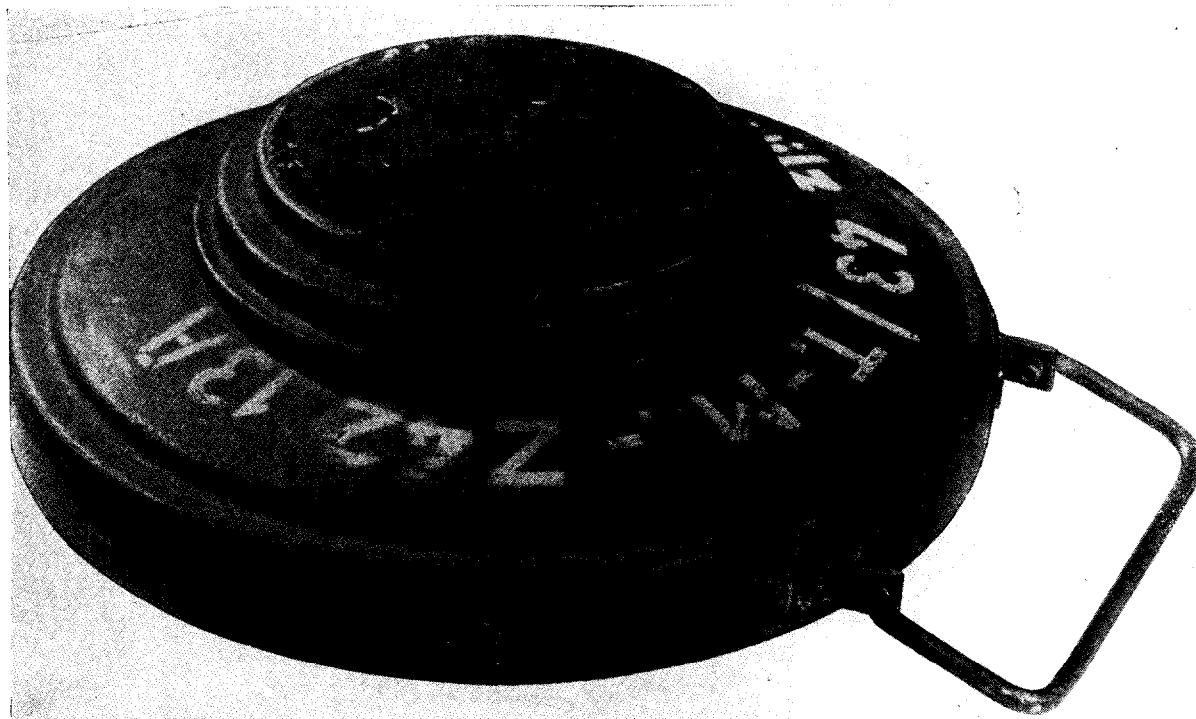


Figure 77.—Tellermine 43 (mushroom).



Figure 78.—Tellermine 42.



Figure 79.—Tellermine 35 (steel)

(3) *Functioning.* The mine functions when a minimum pressure of 495 pounds on the pressure plate causes the hexagonal cap to descend on the head of the plunger and shear the pin which retains the striker in the body of the igniter.

d. **TELLERMINE 35 (STEEL) (*T.Mi.35 Stahl*).** This mine, 12½ inches in diameter, weighs 21 pounds. Painted a mat gray, it is marked *T.Mi.S 31 T VII. 242* on the top in white paint; *S88 12 42A*, on the top in black paint; and *W'O 42*, stamped on the top. In this model the pressure plate which extends over the entire mine is fluted, probably to prevent sand from blowing off when the mine is buried. In the center of the pressure plate is a threaded socket, closed by a screwed plug with a milled head. This socket will take the standard *T.Mi. Z.35* igniter, but the mine can also be used with the igniter assembly of the Tellermine 42. The subsidiary igniter sockets are located on the bottom and side of the mine.

e. **TELLERMINE 35 (*T.Mi.35*).** (1) *Description.* This is a circular mine with a flat base and slightly convex cover. A strong spiral spring inside the mine holds the cover against the turned-in flange of a skirt screwed to the outside of the main body. The central hole for the main igniter

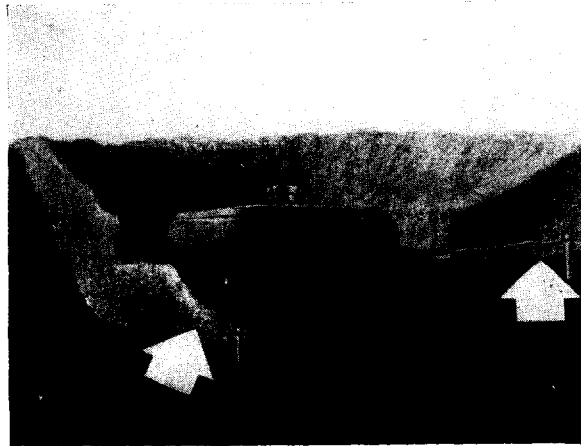


Figure 80.—Tellermine 35 with anti-lifting devices.

(*T.Mi.Z.35* or *T.Mi.Z.42*) is provided with a rubber washer to make a close joint with the body. When the *T.Mi.Z.42* is used, a steel plug must be placed in the central well. Two holes for additional igniters are provided. The central tube, which takes the exploder system, contains the detonator, above which are two metal collars. Above these is a rubber ring, capable of compression to make the assembly watertight. The igniter screws into the cover of the mine, so that



Figure 81.—Tellermine 35.

the lower face of the igniter presses hard against the rubber ring. One collar is a retaining collar for the detonator; the other is an adjusting or positioning collar for the igniter. The igniter is screwed into the correct position by a special tool, and when positioned it is secured by a small grub passing through the collar. If this collar has been removed, it cannot be replaced correctly unless the special tool is available. Incorrect positioning makes the mine either too sluggish or too sensitive.

(2) *Characteristics.*

Diameter12.6 inches.
Weight of mine19.2 pounds.
Weight of filling11 pounds.
Type of fillingTNT.

(3) *Functioning.* The mine functions when the pressure on the cover compresses the mine spring, causing the body of the igniter to descend and shear the pin holding the striker. Pressure of 175 to 400 pounds will explode the mine.

(4) *To neutralize.* Examine the sides and bottom of the mine for anti-handling igniters. Identify the igniters and neutralize. Remove the main igniter from the mine, manipulate the safety device, and immediately replace the igniter.

f. TELLERMINE 29 (*T. Mi. 29*). (1) *Description.* This mine was the first of the Tellermine series and was thought to have become obsolete, but it has been found in France since D-Day. It consists of a cylindrical body the lid of which is provided with three sockets for the reception of three Z.D.Z. 29 push-pull igniters. These igniters, according to a German document, are to be set at the heavy pressure setting (marked S or 125 kg.). Three additional sockets, two in the side and one in the base provide means of attaching anti-handling igniters.

(2) *Characteristics.*

Diameter10 inches.
Height27 inches.
Weight13.2 pounds.
Weight of filling10 pounds.
Type of fillingTNT.
Firing pressure100-275 pounds.

(3) *Neutralization.* Search for and neutralize anti-handling devices. Unscrew the three igniters. The mine is now safe.

g. *L. Pz. ANTITANK MINE.* (1) *Description.* This is a circular mine with flat top and bottom, enclosed in two saucer-shaped covers. In the center of the top is a small cover plate secured by bayonet catches under which is a safety screw.

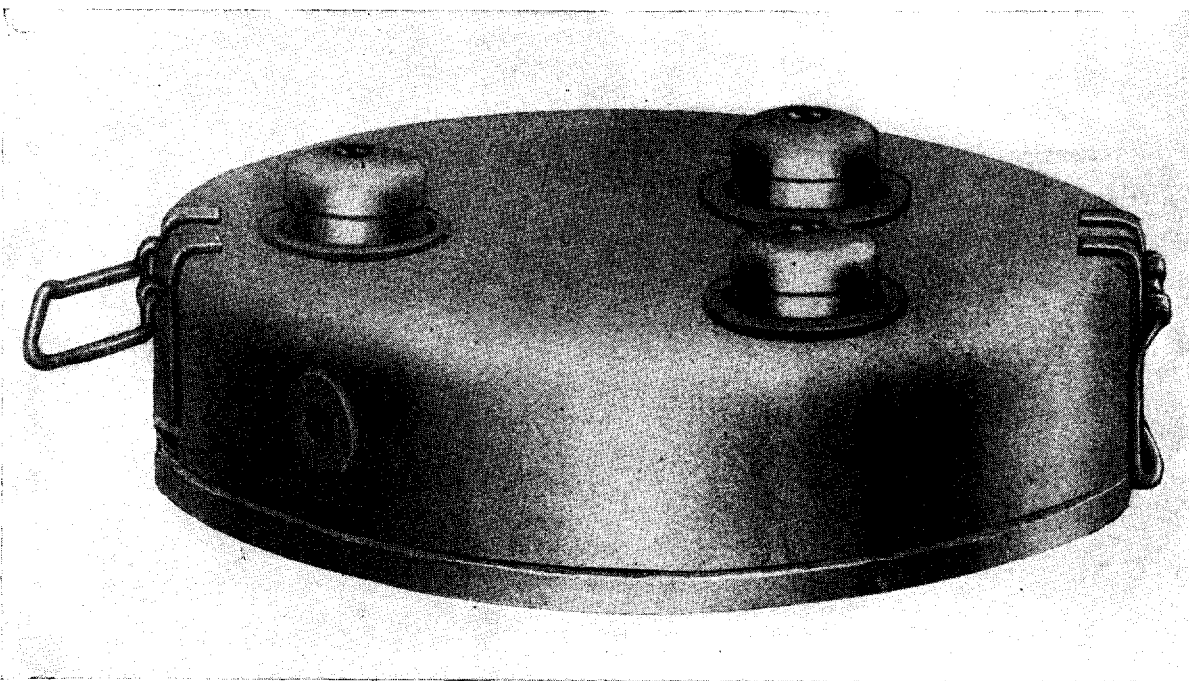


Figure 82—Tellermine 29.

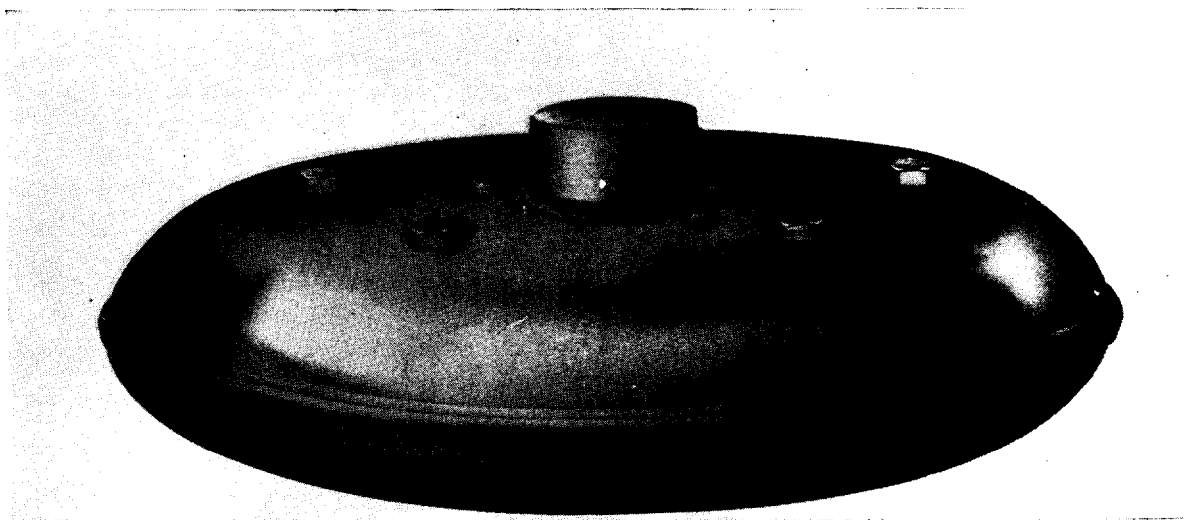


Figure 83.—L. P. Z. Mine.

which when screwed tightly clockwise closes the entry to the detonator. Above the blasting cap is a small chamber from which fire tubes lead radially to the five special pressure igniters action of which is similar to that of the *D.Z. 35* pressure igniter.

(2) *Characteristics.*

Diameter of mine1 foot.
Height3 inches.
Weight of mine8 pounds.
Weight of filling.....5 pounds.
Nature of filling.....TNT.

(3) *Functioning.* Pressure on the lid causes one or more of the igniters to fire, setting off the mine.

(4) *Neutralization.* Search for and neutralize any anti-handling devices. Remove cap and screw safety screw clockwise until line marked *SICHER* coincides with white mark on case. If all the nuts on the bottom of the mine are present and screwed up, mine is safe.

h. *Topf MINE.* (1) *Description.* The mine body is a hollow cylindrical disc of plastic material filled with HE. Its top face is formed as a circular pressure plate surrounded by a shear groove. The cylindrical recess in the center of the mine body accommodates the primer plug. The carrying handle is fixed to the mine bottom by two glass screws.

The primer plug assembly consists of a glass screw cap and the cylindrical igniter seating, made of bituminous cardboard material.

(2) *Action.* Under a load of 330 pounds, the pressure plate shears along its shear groove and comes to rest on the pressure head of igniter, crushing it and causing the mine to explode.

(3) *To neutralize:*

(a) Search for and neutralize any anti-handling devices.

(b) Ensure that the mine is undamaged.

(c) Lift carefully, rest on one side, and unscrew the primer plug.

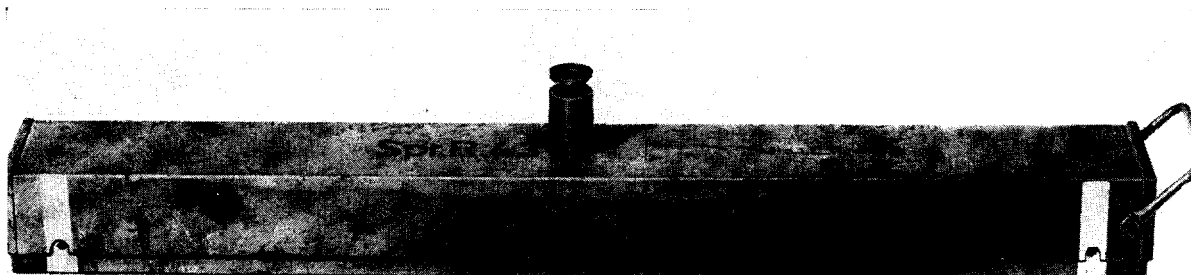


Figure 84.—Riegelmine 43 (R. Mi. 43).

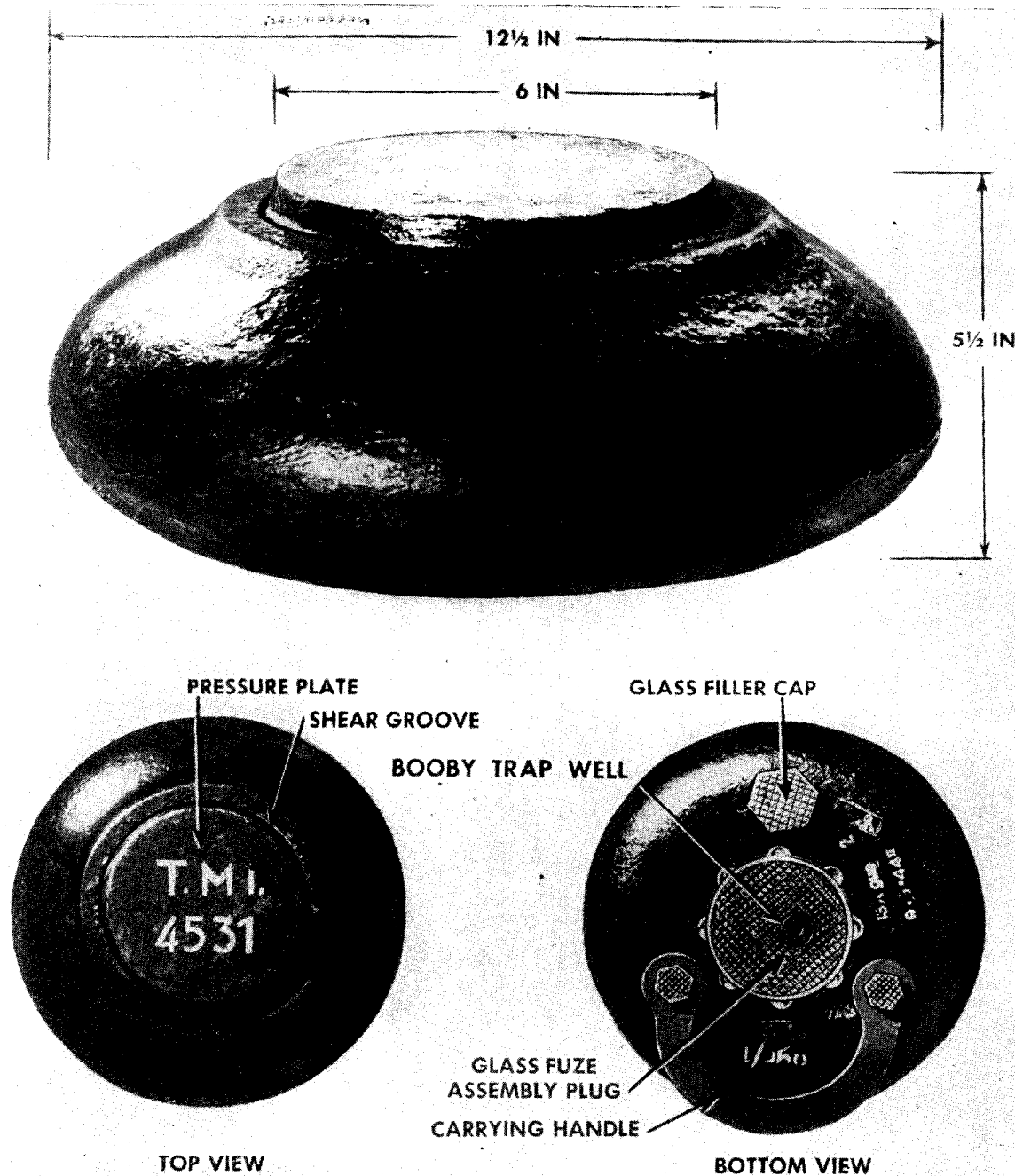


Figure 85.—Topf Mine.

- (d) Remove the igniter.
- (e) Unscrew protective detonator pocket.
- (f) Remove the detonator and replace the protective pocket on the igniter.

i. *Riegel*. ANTITANK MINE (*R. Mi. 43*). (1) *Description*. The mine consists of an encased explosive charge and of an outer box in two parts, lid and tray. The charge is provided

with five standard igniter sockets, one on top, two on one side, and one at each end. Holes in the box correspond with the sockets on top and on the side, enabling igniters to be inserted from outside and fitted as anti-handling devices.

Z.Z. 42 igniters are inserted in the end sockets and their pins rest on shoulders at each end of the tray and are covered by swivel clips. The charge is supported in the tray by two shear

wires. For transport, two safety bars are inserted which take the weight of the charge off the shear wires. When the safety bars are withdrawn, spring-loaded shutters close the holes. These shutters can be opened by pushing a pencil or large nail through a hole in the base of the tray.

The lid rests on the charge, and the ends of the shear wires are led up over the lid and windlassed together to keep it on.

(2) *Characteristics.*

Length31.5 inches.
Width3¾ inches.
Height3½ inches.
Weight of mine20.5 pounds.
Weight of explosive...8.8 pounds.
Nature of explosive....Amatol 50/50.

(3) *Functioning.* Pressure on the lid of the mine shears the shear wires and the pins of the Z.Z. 42 igniters are pushed out, thus setting off the mine.

(4) *Neutralization.* Search for and neutralize any anti-handling devices. Turn the mine on its side and by pushing a pencil or nail through the hole in the base raise the shutters covering the safety bar holes. Insert safety bars. Cut shear wires and remove lid. Open swivel clips and, having seen that the pins of the Z.Z. 42 igniters are resting on the shoulders and not beneath, take out the charge case. Unscrew the Z.Z. 42 igniters.

NOTE: The charge case can be inserted with one Z.Z. 42 igniter pin reversed and beneath the shoulders. In this case the charge case must be slid out by lifting the end in which the Z.Z. 42 igniter is used normally.

j. *FRENCH LIGHT ANTITANK MINE.* (1) *Description.* The mine body consists of a rectangular steel body filled with 5¾ pounds of HE. In the top of the mine are two igniter pockets, one at either end. The body is covered with a slip-on rectangular cover the top of which is corrugated. There is a square hole in either end of the cover

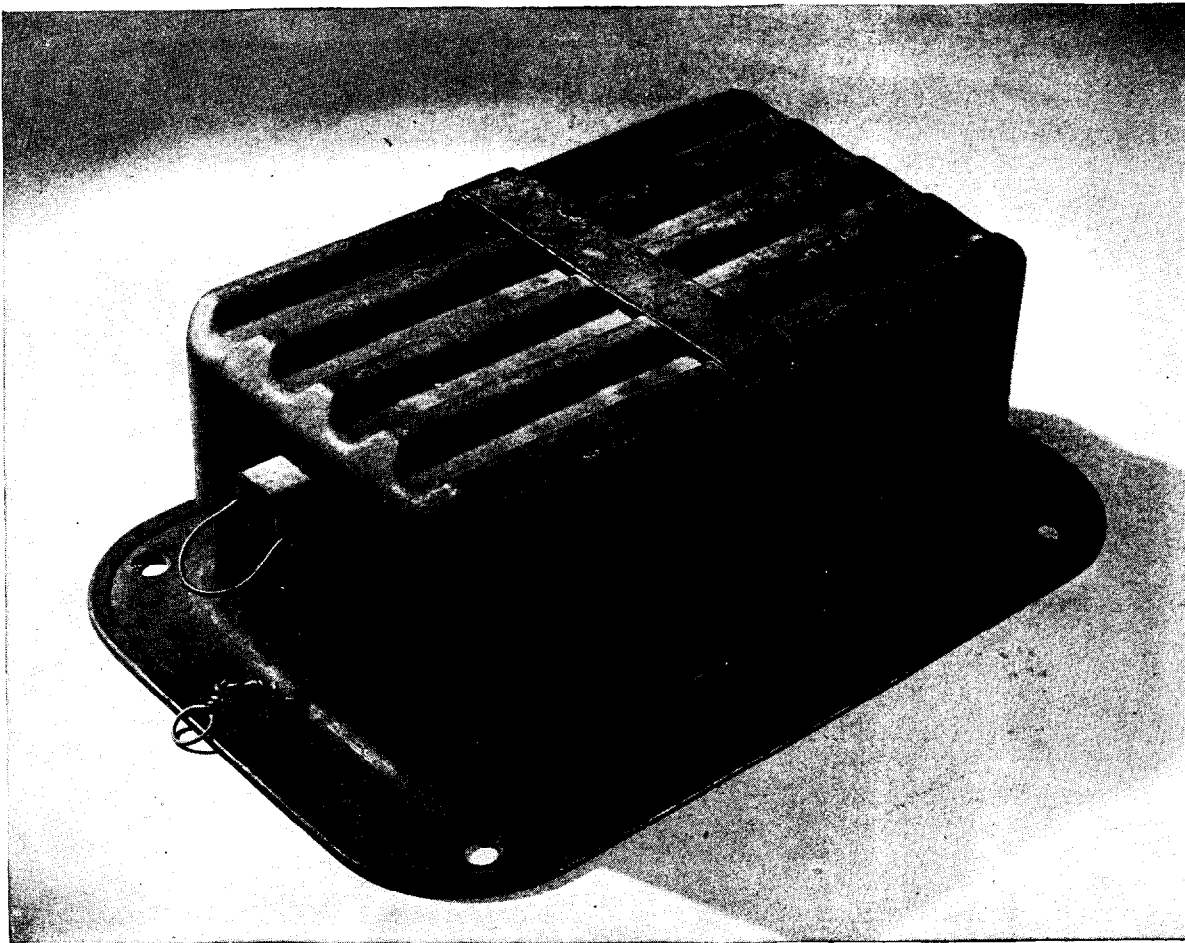


Figure 86.—French light antitank mine.

through which passes a safety bar which is removed when the mine is laid.

(2) *Action.* A pressure of from 300 pounds to 500 pounds in the lid causes it to descend on the igniters, exploding the mine.

(3) *Characteristics.*

Length9½ inches.
Width5½ inches.
Height4½ inches.
Weight14½ pounds.

(4) *To neutralize:*

(a) Search for and neutralize any anti-handling devices.

(b) Lift cover and remove both igniters.

(c) Replace the cover.

k. WOODEN-BOX MINE 42 (*Holzmine*). (1)

Description. The body of the mine is a rectangular wooden box containing 11½ pounds of HE. A pressure block protrudes through the lid of the mine, which inside the mine rests on a

shear flange secured to the side of the mine by wooden dowels.

The mine is gray or unpainted, with a red band on one side and on the face of the pressure block.

(2) *Action.* Pressure of 200 pounds or more on the pressure block shears the dowels securing the shear flange, which when forced down pushes out the pin in the Z.Z. 42 igniter, exploding the mine.

(3) *Characteristics.*

Length13 inches.
Width12 inches.
Height4½ inches.
Weight18 pounds.

(4) *Neutralizing.* Search for and neutralize any anti-handling devices. Remove the lid avoiding all pressure on the pressure block. Lift pressure block clear of the shear flange. Place the pressure block so it bears on the supporting block in the unarmed position. Replace the lid.

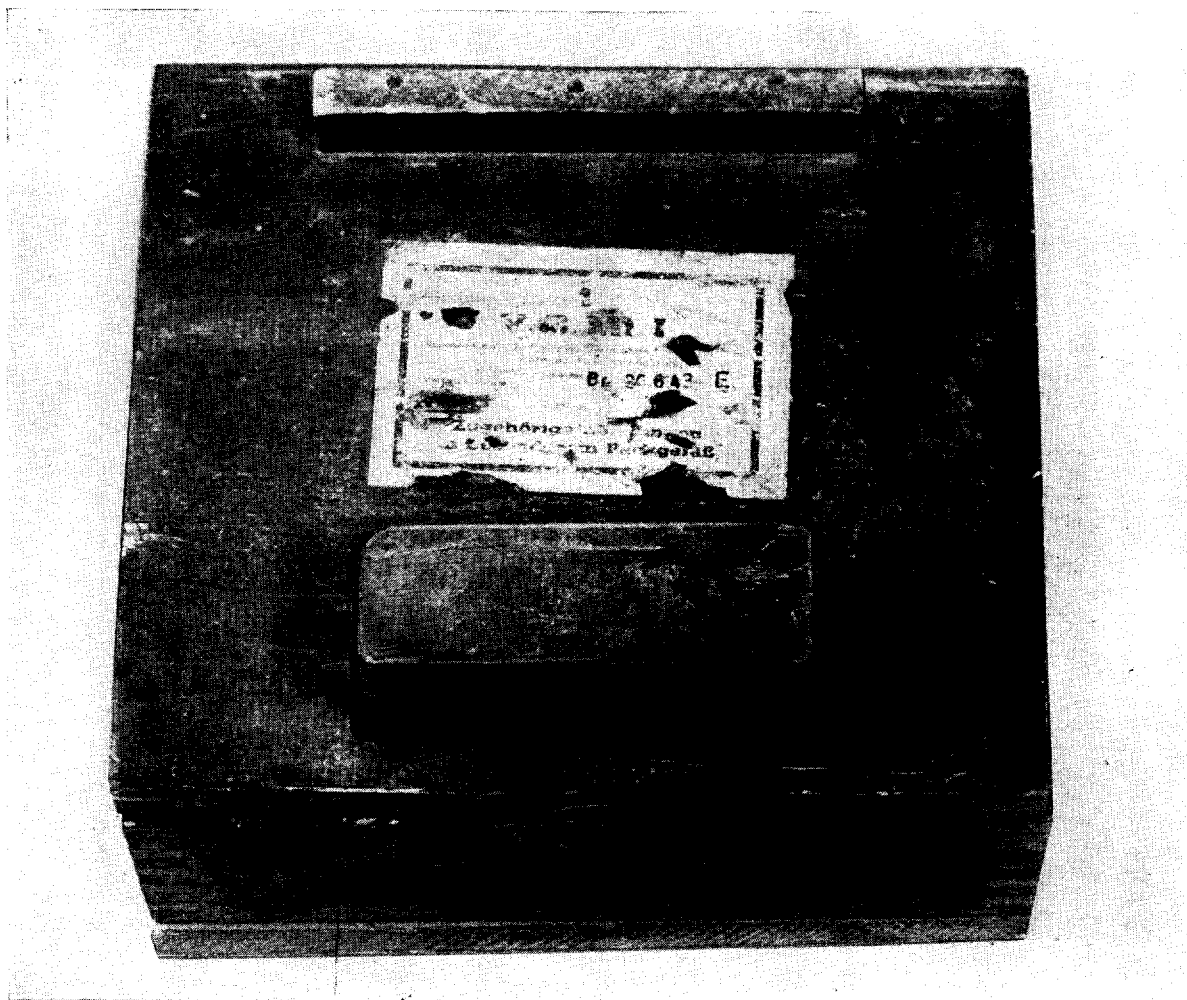


Figure 87.—Wooden Box Mine 42.

ANTITANK MINES IN USE BY THE GERMANS

NAME	Length (Inches)	Width (Inches)	Height (Inches)	Weight (Pounds)	Igniter	Firing load (Pounds)	REMARKS
Tellermine 35.	12.5 (diam.)		3.2	20	T.Mi.Z. 35 or T.Mi.Z. 42	175- 400	Fitted for anti-handling devices.
Tellermine 35 (steel).	12.5 (diam.)		3.5	20	T.Mi.Z. 35 or T.Mi.Z. 42	175- 400	Fitted for anti-handling devices.
Tellermine 42.	12.5 (diam.)		4	20	T.Mi.Z. 42	250- 400	Fitted for anti-handling devices.
Tellermine 43 (Mushroom).	12.5 (diam.)		4	20	T.Mi.Z. 42	440- 600	Fitted for anti-handling devices.
Tellermine 29.	10 (diam.)		2.7	13.2	Z.D.Z. 29	100- 275	Three igniters used.
L. PZ. AT Mine.	10.25 (diam.)		2.25	9	Five special pressure igniters.		Paratroop mine.
Topf Mine.	12.5 (diam.)		5.5	21.775	Chemical Non- metallic.	330	Non-metallic mine.
Riegel Mine (R.Mi.43).	32.75	4	3.5	20.5	ZZ.42	400	Fitted for three external igniters for anti handling.
Wooden Box Mine (42). Holzmine 42.	12	12	4½	18	ZZ.42	200	
Wooden Box Mine V.B.1. Holzmine V.B.1.	12	12	4	20	ZZ.42	200	
Heavy Wooden AT Mine.	17	15.75	10.5	37	DZ.35	200	Fitted for anti-handling devices.
Panzer Schnellmine, Type A.	20.75	13	5	16 (approx.)	ZZ.42		Locally produced improvised mine.
Type B.	20.75	13	5	16 (approx.)	Buck igniter.		
Improvised Aluminum Mine.	12.5 (diam.)		4.75	14 to 16½	DZ.35 or T.Mi.Z. 42	130- 390	
C.V.P. 1 AT & Apers. Mine (Hungarian)	10 (diam.)		3	8		60	
French Light AT Mine.	9.5	5.5	4.5	14.5	Rod 35 Rod 36	420- 500	
Dutch AT Mine T. 40.	11 (diam.)		3.5	13.2	Pressure ball release type.	100	Oval section.
AT Mine Type N. (Norwegian).	15.75	5.5	5	10	Pressure	?	
Belgian Heavy AT Type HA.	9	8.75	8.5	33	Shear Pin and Striker.	400	

Figure 88.

7. Igniters

a. PULL IGNITERS. (1) *Bakelite Z.Z.42 (Zugzünder 42)*. The pin, the striker, and the actuating spring of this igniter are steel. The body and the collar are plastic mouldings, and the cap holder is brass. Between the lower end of the spring and the striker head are a metal washer and a felt washer which act as a guiding gland. The over-all length is $3\frac{7}{16}$ inches, and the diameter is $\frac{1}{2}$ inch.

(2) *Zugzünder 35 (Z.Z.35)*. (a) *Description*. This igniter is used with trip wires to operate S-mines, improvised mines, and booby traps. The heavy antitank mines have this igniter as a booby trap against lifting the lid, and it also is used as an extra igniter in Tellermines and as the main igniter in the drifting mine. The brass body of the igniter contains a sliding cylinder, a compressing spring, the striker, and the striker spring. In the unarmed position, the safety pin is prevented from falling out by a nut on the end of the pin and by a spring clip. When the nut is removed prior to arming, the clip still holds the pin in place until it is pulled away by a cord.

(b) *Operation*. In the armed position the striker is held only by two small cotters, which project into the groove behind the head of the striker. When the sliding cylinder is pulled up about $\frac{3}{16}$ inch, the cotters are freed and move outwards, releasing the striker. The pull required to fire the igniter is 9 to 13 pounds.

(c) *To neutralize*. The igniter is made safe by pushing a small nail through the hole in the striker. The trip wire then may be cut.

(d) *To disarm*. When the igniter is fitted into a mine or charge, unscrew the igniter with the nail in place and remove the detonator.

(3) *Zug-und Zerschneidezünder 35 (Zu. Z.Z.35)*. (a) *Description*. This igniter is used chiefly in places where tension wires are easily concealed. It functions in two ways—either by pull on a wire or by cutting the wire. In both cases it is set by securely fastening a wire through the hole in the head of the movable cylinder. The body of the igniter contains a movable cylinder, a striker spring, and the striker. The striker is held in position by two cotters. The movable cylinder slides inside a sleeve fitted in the end of the main housing. This sleeve has two slots through which the safety pin passes. These slots allow for adjustment of the igniter when setting the charge. When the igniter is to be armed, the

wire is attached to the cylinder and given enough tension to hold the safety pin near the center of the slot. This ensures easy withdrawal of the safety pin after the charge or mine has been laid. Before withdrawal of the pin the nut is removed from the end of it.

(b) *Operation*. When properly armed the igniter will function if the tension wire is pulled or cut.

(c) *To neutralize*. If the safety pin has been removed, and the tension wire is intact, push a small nail through the safety-pin hole, and, after determining that there is no igniter on the other end of the wire, the wire may be cut.

b. PRESSURE IGNITERS. (1) *Druckzünder 35 (DZ.35 Type A)*. (a) *Description*. This is a mechanically-acting, push igniter, designed for use with improvised mines and booby traps. It is also the main igniter of the heavy antitank mine. It consists of an aluminum body and a plunger which carries the $1\frac{1}{4}$ -inch pressure head. The plunger is held away from the cap by a strong spring. Within the plunger is a recess for the striker and spring. Two steel balls rest partly in two holes in the plunger and retain the striker in the cocked position. When in the safe position, the plunger is prevented from moving by a safety pin.

(b) *Operation*. After withdrawal of the safety pin the igniter is fired by pressure on the head, which depresses the plunger until the steel balls are free to escape into the space in the guide. The striker then is released and fires the cap. A pressure of 130 to 160 pounds (corresponding to a depression of about $\frac{1}{3}$ inch) is sufficient to fire the igniter.

(c) *To neutralize*. Push a nail into the safety pin hole and secure it in place to prevent its falling out.

(d) *To disarm*. After neutralizing the igniter, unscrew it from the charge and remove the detonator.

(2) *Druckzünder 35 (DZ.35 Type B)*. (a) *Description*. This igniter functions exactly the same way as type A, though its construction differs in a few minor details. The body is made of unpainted brass, and the diameter of the pressure head is 1 inch. The retaining steel balls are replaced by two small cotters, placed below the head of the striker. The cap is located in the base plug.

(b) *Operation*. After withdrawal of the safety pin, the igniter is fired by pressure on the head.

When the plunger is depressed about $\frac{1}{3}$ inch, the two small cotters escape from the guide into the space below. The striker then is released and fires the cap. The pressure required in some cases is as low as 50 pounds.

(c) *To neutralize.* Same as for Type A.

(d) *To disarm.* Same as for Type A.

(3) *S-Minenzünder 35 (S.Mi.Z.35).* (a) *Description.* This igniter is used to initiate the S-mine when set as a pressure operated charge. The body of the igniter is made of aluminum and holds a pressure spring, plunger, striker, and striker spring. A central part of the body acts as a distance piece and guide for the plunger. Three steel antennae, $1\frac{1}{4}$ inches long, are screwed to the head of the plunger. This hollow plunger takes the striker, which is held in position against its spring by two steel balls. The balls are held partly in two holes in the plunger and partly in a groove in the striker. The safety pin is retained in its hole by a spring-loaded and milled nut. When the safety pin is withdrawn, the mine is armed.

(b) *Operation.* Pressure on the antennae causes the plunger to descend, and after moving approximately 0.2 inch the steel balls fall away releasing the striker. The firing pressure is approximately 15 pounds.

(c) *To neutralize.* Push a nail into the safety pin hole. Care must be taken in handling this igniter as a slight steady pressure may cause it to function.

(4) *Tellerminenzünder 42 (T.Mi.Z.42).* This igniter consists of a simple steel striker retained against the pressure of a steel spring by a shear wire. The striker is in a steel casing. A percussion cap is at the base of the casing. The pressure necessary on the head of the striker is approximately 400 pounds.

(5) *Tellerminenzünder 43 (T.Mi.Z.43).* (a) *Description.* The chief feature of this igniter, which can be used in Tellermines 35, 35 (steel), 42, and 43, is that once it has been placed in the mine and armed it cannot be removed without exploding the mine. The head of the *T.Mi.Z.43* is approximately $\frac{1}{4}$ inch higher than that of the *T.Mi.Z.42*. The upper shear pin is $\frac{1}{4}$ inch above the body of the igniter. The outer ends of the arming shear pins can be seen on the sides of the igniter body, either $\frac{1}{2}$ inch or $\frac{7}{8}$ inch below the top of the igniter body. The igniter consists of a body into which is pressed a cap retainer. Inside is a pressure sleeve, which protrudes above the

casing. The upper part of the sleeve is fitted with a strong shear pin, and the lower part is connected to the igniter body by a weak brass arming wire. Inside the pressure sleeve is a plain tubular striker guide containing the striker, held in place by two retaining balls.

(b) *Operation.* The igniter is inserted in the normal manner, and the top of the mine is screwed on. This depresses the pressure sleeve, which in turn shears the weak arming pins with an audible snap. The anti-lifting device of the igniter now is armed. The igniter can be set off in either of two ways. When the pressure plate is crushed or depressed, the sleeve is pressed down until the strong shear pin is cut. The retaining balls escape into the recess above the shoulder of the sleeve, freeing the spring-loaded striker which fires the percussion cap. Any attempt to unscrew the pressure plate or cap of the mine will cause it to explode. Under pressure of the spring the sleeve follows any upward movement of the plate or cap and after about $\frac{1}{8}$ inch upward travel the balls escape below the sleeve, again releasing the striker.

(c) *Disarming.* Since there is no way to determine whether a Tellermine is armed with this igniter, no pressure plate or screw caps should be removed from these mines. They should be lifted and destroyed. However, should it be necessary to determine the type of igniter, wind a rope or tracing tape counter-clockwise around the pressure plate or screw cap four complete times. Then pull from a safe distance to unscrew the plate or cap.

(6) *T.Mi.Z.35.* (a) *Description.* This pressure igniter has only been found in Tellermines. The brass body contains a floating striker assembly. The striker head is stepped to fit a projection on the spindle. This is a secondary safety device to keep the weight of the striker off the shear pin until the igniter is armed. A white mark with the word *Sicher* (safe) above it, and a red mark with the word *Scharf* (armed) above it are inscribed on the head of the igniter. When the screw head is turned so the red spot moves from the safe to the armed position, the projection moves clear of the striker head.

(b) *Operation.* In the mine the lower face of the guide compresses the ring situated above the adjusting collar. Pressure on the cover of the mine moves the body of the igniter down against the rubber on the collar and so exerts a force on

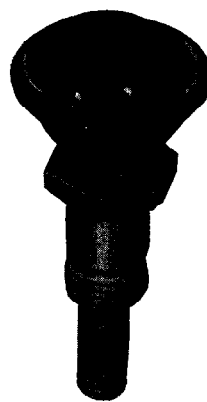
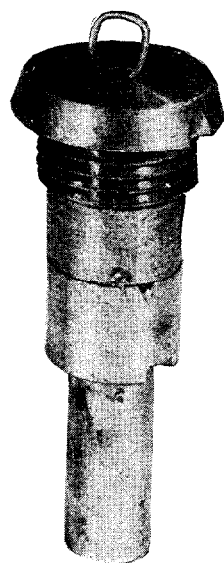
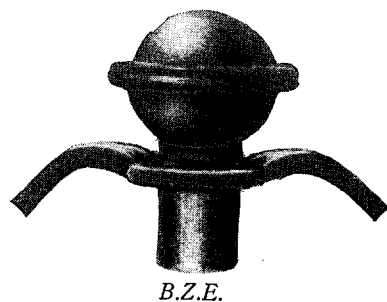
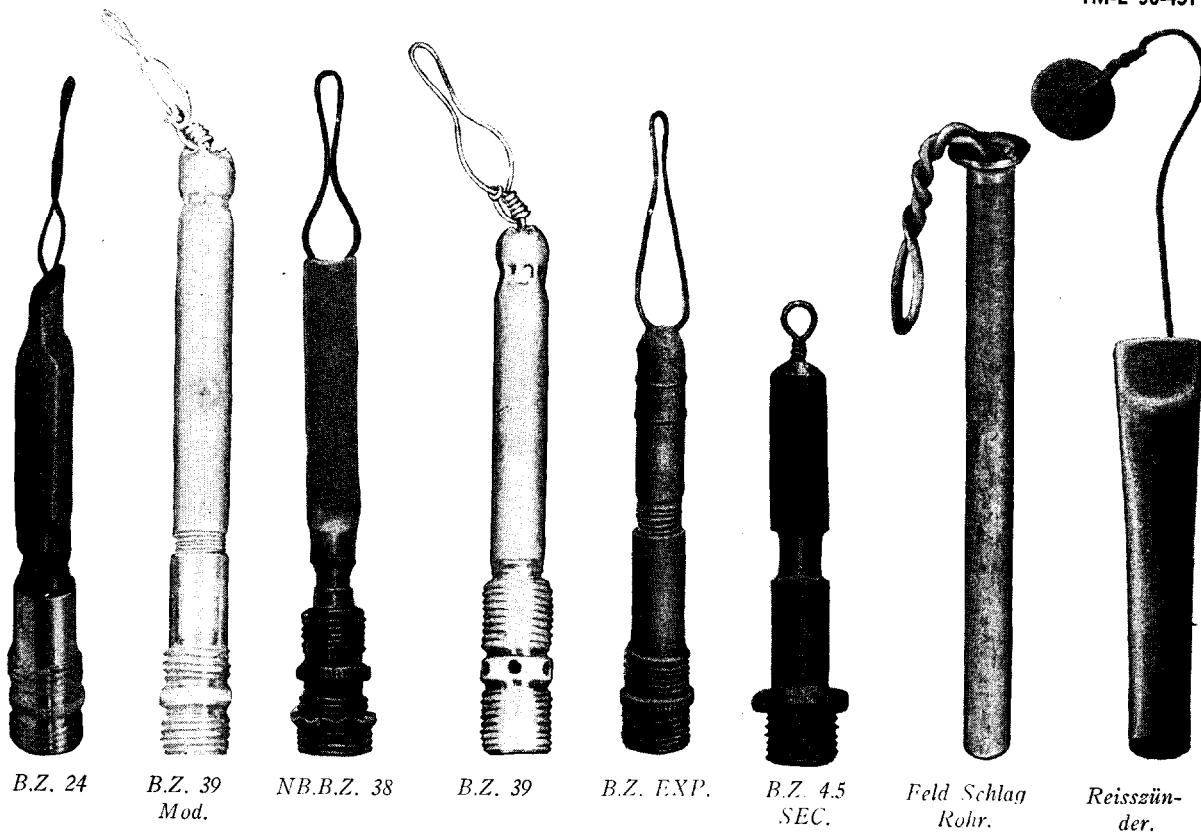


Figure 89.—Friction Igniters.

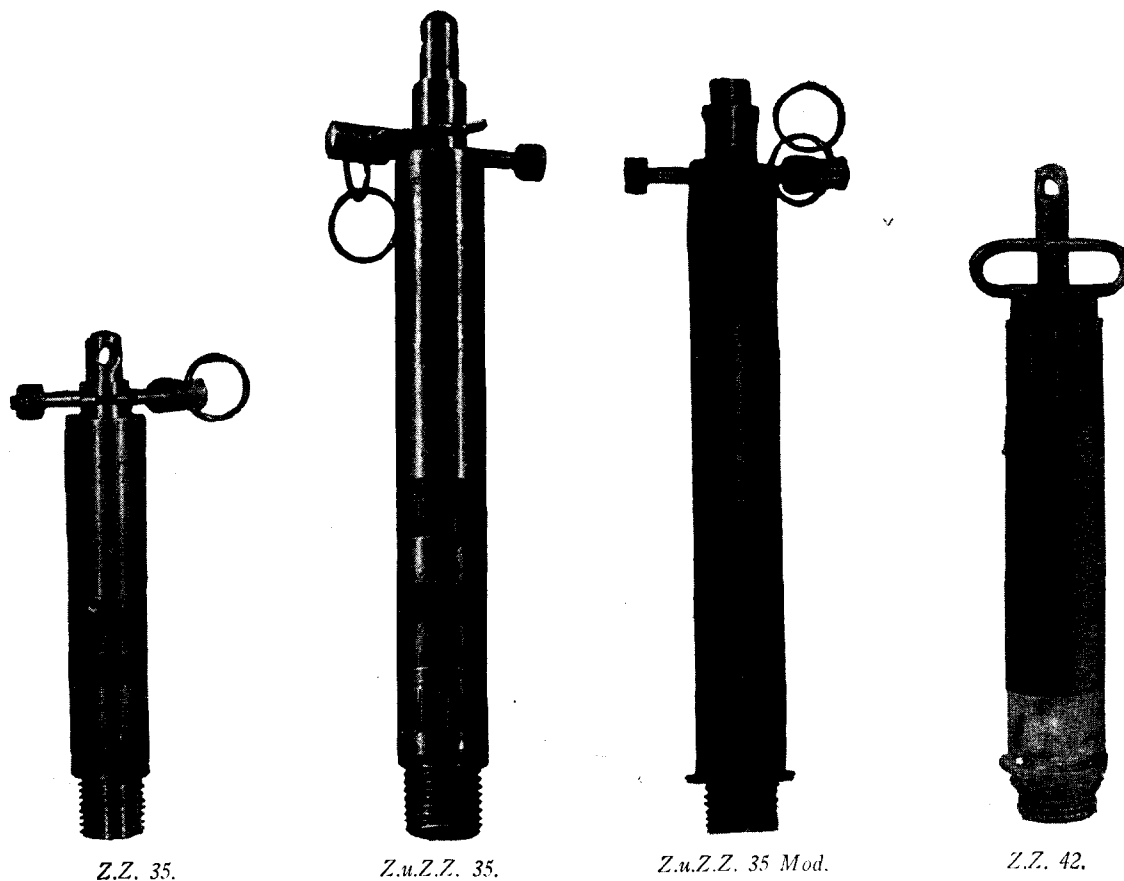


Figure 90.—Pull Igniters.

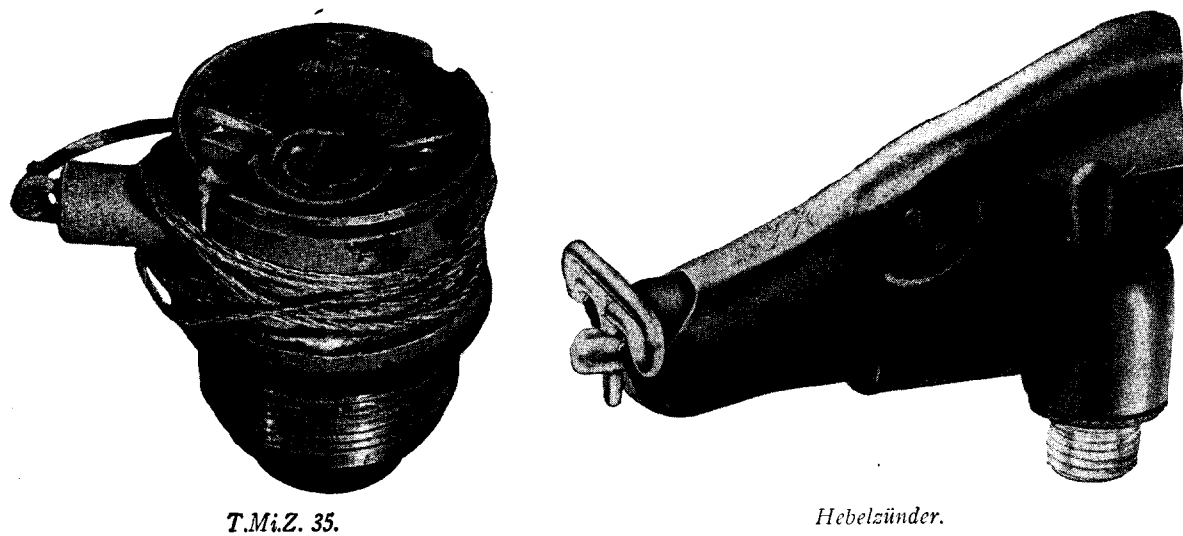
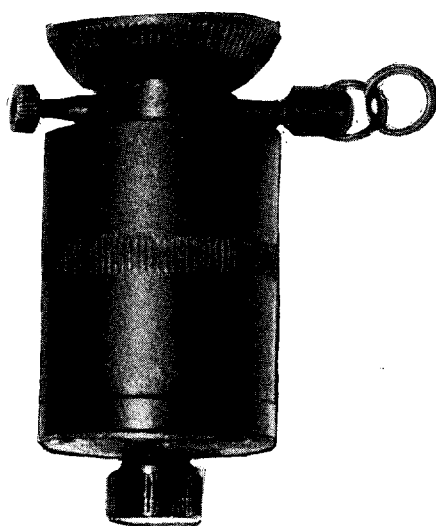
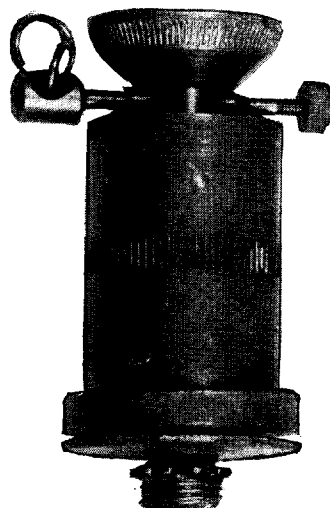


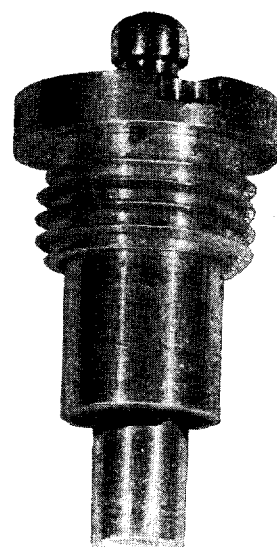
Figure 91.—Pressure Igniters.



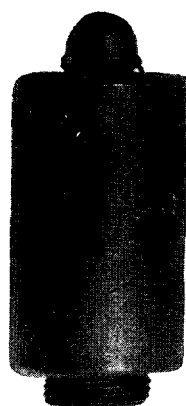
D.Z. 35(A).



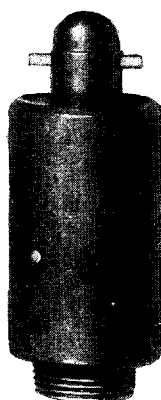
D.Z. 35(B).



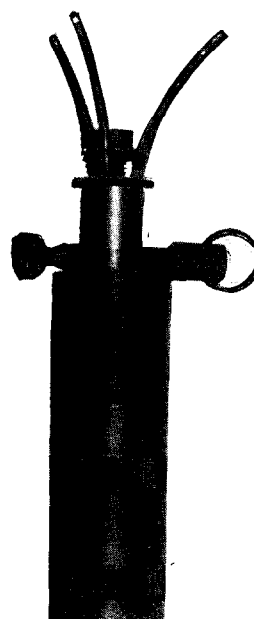
French A.T.



T.Mi.Z. 42.



T.Mi.Z. 43



S.Mi.Z. 35.

Figure 91 (Continued).

top of the striker, shearing the pin. The striker then moves under the pressure of the spring.

(c) *To neutralize.* If the mines have been subjected to blast, unscrew the igniter gently. Hold the igniter clear of the mine with the cap pointing away. Turn the red spot on the screw head from *Scharf* to *Sicher*. Fix the claw attached to the wire, or a similar improvisation, into the slotted end of the safety bolt, and press the safety bolt home. Replace the igniter in the mine, screwing it in hand tight. If the mines are known to be in good condition, turn the red spot from *Scharf* to *Sicher*, using a coin, not a screwdriver. Fix the claw attached to the wire into the slotted end of the safety bolt and press the bolt home.

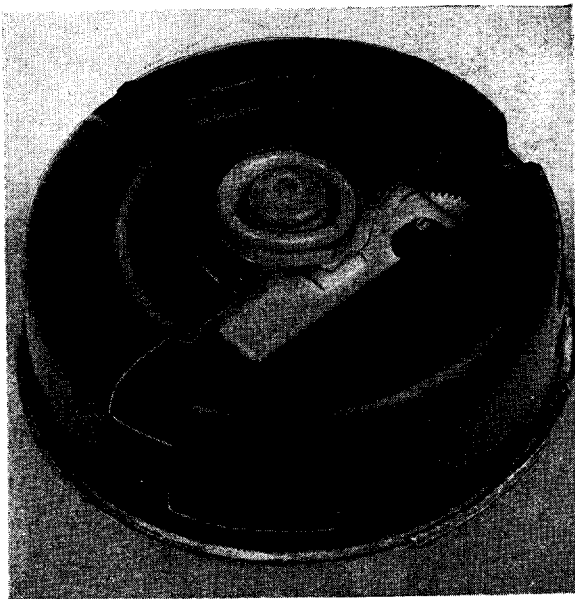


Figure 92.—Pressure Release Device E.Z. 44.

c. OTHER IGNITERS. (1) *Pressure Release Device, E.Z.44 (Entlastungszünder 44).* (a) *Description.* This device is intended primarily for booby-trapping Tellermines. Any attempt to remove the mine permits a plunger to rise, setting off an 8-ounce charge of TNT-PETN. A weight of 10 pounds is sufficient to hold the device in the armed position, and a built-in clockwork, time-delay protects the person setting it from premature detonation. The device is housed in a steel body crimped at the base. The operating mechanism fills one-half of the container, while the explosive occupies the remaining space. The operating mechanism includes the pressure release assembly, including plunger, plunger spring, and striker retaining arm; the clockwork mechanism; and the firing assembly, including striker,

striker spring, percussion cap, detonator holder, and detonator.

(b) *Operation.* The clockwork mechanism is wound. A weight of at least 10 pounds is placed on the plunger. The safety bar is released, permitting the clockwork mechanism to function for 1½ minutes with a loud buzzing sound, withdrawing the internal safety pin. The device now is armed.

(c) *To neutralize.* Once this device is armed it cannot be neutralized.

(2) *Tilt Igniter, Ki.Z.43 (Kippzünder 43).*

(a) *Description.* The tilt igniter is designed to fire whenever the tilt rod is moved in any direction. This tilt rod is on top of the igniter, which contains a sliding pressure piece, pressure spring, hollow striker, striker spring, and two retaining balls. The detonator assembly includes percussion cap and detonator. An extension rod, 24¾ inches long, is connected by pushing the sleeve over the tilt rod.

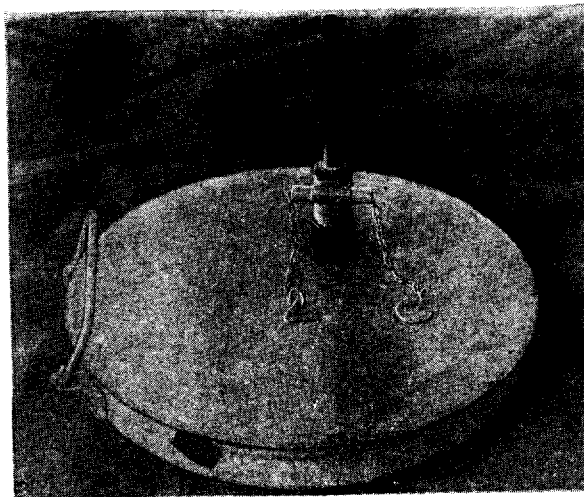


Figure 93.—Tellermine with Tilt Igniter attached.

(b) *Operation.* The igniter is armed by removing the safety pin. When the tilt rod is moved in any direction, the tilt-rod base is tilted inside the igniter body, depressing the pressure piece, thus freeing the striker. A lateral pressure of 15 to 23 pounds on the end of the tilt bar will fire the igniter. Use of the extension rod reduces the pressure needed to explode the igniter to 1½ pounds.

(3) *S-Mine Igniter 44.* (a) *Description.* This igniter is a combination push-and-pull type, with the standard German igniter thread. It can be used in mines and charges other than the *S.Mi.*



Figure 94.—Clockwork Long-delay Igniter (J-Feder 504).

44. The steel case of the igniter contains a spring-loaded striker above a percussion cap and detonator socket. The striker protrudes through the top of the igniter. Two flat, winged, actuating pieces are held together at the top by a safety pin. Holes in these pieces serve for the attachment of trip wires.

(b) *Operation.* The igniter is armed after the safety pin is withdrawn. A pressure of 21 pounds on the wings of the actuating pieces, or an outward pull of 14 pounds on the trip wires, opens the winged actuating pieces sufficiently to release the striker and fire the percussion cap.

(c) *To neutralize.* This igniter requires extreme care in neutralization. In place the igniter is completely covered, leaving only the wings exposed. Carefully locate the wings and remove enough earth to insert a safety pin or nail through the pin holes. If trouble is encountered in inserting the pin or nail, the mine is dangerous

and should be destroyed in place. Unscrew the igniter, lift the mine, and remove the detonator.

(4) *Clockwork long delay igniter (J-Feder 504).* This igniter is a clockwork mechanism that may be set to function at any desired delay from 10 minutes to 21 days. It is used for special demolitions.

(5) *Crush Type Chemical "Buck" Igniter.*

(a) *Description.* This igniter is a chemical, crush-actuated type, consisting of a thin metal drum, with circumferential grooves to reduce its resistance to vertical pressure. It contains a glass ampule half filled with acid, surrounded by a white, powdered, flash composition. It weighs 1 ounce.

(b) *Operation.* A moderate pressure on top of the igniter crushes the metal drum and the glass ampule inside it. The acid pours into the white powder, and a flash results, setting off detonator and mine.

8. Bridging Equipment

a. GENERAL. (1) *Development.* Apart from the introduction of a 60-ton type in the armored division bridging column, German bridging equipment has undergone few important changes since the beginning of the war. Standard types are not numerous; particular emphasis is placed upon the construction of improvised bridges at the earliest possible stage of a river crossing.

(2) *Bridging operations.* The initial stage of an assault crossing is carried out by storm boats. These may be supplemented by pneumatic boats supplied in three sizes. Once a bridgehead has been established, pneumatic boats play an important part, either in ferrying personnel and stores, or in construction of rafts and light bridges. The superstructure for these light bridges consists of standard timber members carried ready for construction. Ready made timber bridges for crossing dry gaps also are carried, and some engineer units carry a light box girder and ponton equipment known as bridging equipment "D". In the third stage of a river crossing, when the bridge is required for normal traffic of approximately 24 tons, bridges from the divisional bridging column are used. Of these, there are two types: bridging equipment "B", a ponton trestle bridge; and bridging equipment "K", a box girder bridge supported on pontoons and trestles. A third type, bridging equipment "J", designed to accommodate the heavier German tanks, replaces the "K" equipment in armored divisions.

(3) *Heavy bridges.* Heavier semi-permanent bridges include the L.Z. bridge, a sectionalized, through-girder type which is launched from a roller bed; the Herbert, with a girder superstructure supported on large sectionalized pontoons, and the "S" equipment, used for heavy traffic over wide rivers and consisting of a double-way superstructure on sectionalized pontoons similar to those of the Herbert. Railway bridges are represented by the Roth-Wagner, Krupp, and Ungaw bridges.

b. BOATS USED IN RAFTING AND BRIDGING.

(1) *Small pneumatic boat.*

Length9 feet 10 inches.
Beam over-all3 feet 9 inches.
Weight116 pounds.
Capacity3 armed men or 660 pounds.

(2) *Pneumatic boat assault bridge.* This bridge can be built in any lengths in a current

up to $2\frac{1}{4}$ knots and will carry infantry in single file.

Weight of superstructure—12.8 pounds per foot.

Total weight of bridge—23.7 pounds per foot.

(3) *Medium pneumatic boat.* (a) *Description.*

These pneumatic boats can be used as supports for the standard German $2\frac{1}{4}$ -ton, $4\frac{1}{2}$ -ton, and 9-ton rafts. The $2\frac{1}{4}$ -ton raft consists of two boats; the $4\frac{1}{2}$ -ton raft has four boats in the form of two pairs in tandem, and the 9-ton raft has three pairs in tandem.

(b) *Characteristics.*

Length over-all18 feet.
Beam over-all6 feet 1 inch.
Weight330 pounds.
Crew7 men.
Capacity, not including crew1.35 tons.

(4) *Motor boat.* (a) *Description.* This craft is used primarily for pushing and towing rafts and bridge sections in bridging operations. It also can be used for river reconnaissance and barge towing. It is transported on a special two-wheel trailer, which is provided with gear so the boat can be launched and recovered direct from the trailer. The motor boat is a broad-beamed craft constructed of steel plates with copper-nickel rivets.

(b) *Characteristics.*

Length over-all.....23 feet.
Beam over-all.....6 feet 7 inches.
Depth amidships.....4 feet.
Draught, fully laden...2 feet (approximately).
Weight of boat unloaded2 tons (approximately).
Capacity, when not towing6 men, including crew, or 1.7 tons evenly distributed on floor boards.
Speed, towing tension 1.4 tons5½ knots.
Speed, towing tension 1,900 pounds7 knots.
Capacity of fuel tank...33 gallons.
Maximum running time on full tank.....6 hours (approximately).

(c) *Engine.* The boat is driven by a six-cylinder, Maybach-type, S5, water-cooled, gasoline engine.

Horsepower80 at 1,400 rpm.
Total engine capacity...7 liters (427 cubic inches) (approximately).

Maximum permissible revolutions in still water1,400 rpm.

(d) *Trailer.* The two-wheel trailer includes chassis, extensible tipping slipway, traveling cradles, winch, and hoisting cable. It has the following characteristics:

Weight, unloaded.....2¼ tons.
 Length over-all.....24 feet 9 inches.
 Length with boat.....28 feet 6 inches.
 Length extended.....32 feet 4 inches.
 Width over-all.....6 feet 7 inches.
 Length of hoisting
 cable49 feet 3 inches.
 Working party.....6 men.

(5) *Storm boat.* (a) *Description.* This boat, when in operation, is carried and launched by eight men, while four men are required to carry and install the motor. The boat is steered by pivoting the motor on the bracket which attaches it to the stern. The helmsman stands in the stern gripping two handles at the front of the motor.

(b) *Characteristics.*

Length19 feet 9 inches.
 Beam5 feet 2 inches.
 Depth amidships.....2 feet 1 inch.
 Weight475 pounds.
 MaterialWood.
 Crew2 men.
 Capacity7 men in addition to crew.
 Maximum speed, loaded.15 to 16 knots.
 Transport3 boats with motors on
 special trailer.

(c) *Engine.* This is a "mechanical oar" propulsion unit: a propeller attached to a long shaft running through a casing bolted to the engine. The propeller revolves several feet behind the boat.

Length13 feet 6 inches.
 Width2 feet 9 inches.
 Height2 feet.
 Weight (without oil
 and fuel).....375 pounds.
 Weight (with oil and
 fuel)412 pounds.
 BHP30.
 Cylinders4, horizontally opposed.
 Running time on full
 tank1½ hours.
 Propeller3 blade, 10¾ inches in
 diameter.

(6) *Large pneumatic boat.* This is the largest of the three standard pneumatic boats and is generally used singly.

Length over-all.....26 feet.
 Beam over-all.....9 feet 9 inches.
 Weight637 pounds.
 Maximum buoyancy.....13.5 tons.

c. PONTON AND TRESTLE BRIDGES. (1)

Training ponton bridge. (a) *Description.* There is little evidence of this equipment being used operationally; it is thought to be kept for training. There are two types of light ponton and trestle bridges: one with half pontoons having a load capacity of 4 tons, and the other with double-ponton piers having a load capacity of 5½ tons. The decking used for this bridge also is used in bridging and rafting with pneumatic boats.

(b) *Characteristics.*

Half ponton:
 Length12 feet.
 Beam5 feet.
 Depth2 feet 6 inches.
 Superstructure:
 Timber with decking.20 feet by 2 feet.
 Track width.....8 feet.
 Bay length.....20 feet.

(2) *Ponton and trestle bridge (Czech).* This equipment consists of steel half pontoons and center sections. Two types of bridges are built.

(a) Roadways built on piers of one half ponton and one center section, with a capacity of 8.2 tons and the following characteristics.

Pier length:
 Half ponton.....16 feet.
 Center section.....8 feet.
 Beam4 feet 6 inches.
 Track width.....8 feet.
 Bay length.....21 feet.

(b) Roadway built on piers of two half pontoons and one center section, with a capacity 16.5 tons and the following characteristics:

Track width.....8 feet.
 Bay length.....21 feet.
 Complete pier:
 Width4 feet 6 inches.
 Length40 feet.

(3) *Light ponton and trestle equipment* (Brückengerät C). The three following types of bridges can be built with this equipment.

Detail	Type 1	Type 2	Type 3
Type of bridge	Footway on half pontons.	Bridge of two pier raft.	Bridge of three pier raft.
Capacity	Single file.	4.5 tons.	5.9 tons.
Floating unit	Timber of aluminum non-reversible half pontons.	Two half pontons clipped together to make pier.	
Unit length	12 feet 9 inches (approximately).	25 feet 6 inches (approximately).	
Unit beam	4 feet 6 inches (approximately).	4 feet 6 inches (approximately).	
Superstructure	Single decking strips.	Four decking strips.	
Track width	2 feet 1½ inches.	8 feet 6 inches.	
Bay length	22 feet 11½ inches.	22 feet 11½ inches.	

(4) *Medium ponton and trestle equipment* (Brückengerät T).

Detail	Type 1	Type 2	Type 3
How used	Bridge with road bearers spanning from center of one ponton to center of next ponton.	As in Type 1 but with an extra ponton in center of span.	A three-pier raft.
Capacity	4.5 tons.	11 tons.	10 tons.
Floating unit	Timber reversible ponton with distinct bow and stern.		As for Type 1.
Length	29 feet 6 inches.		Same as Type 1.
Beam	5 feet 11 inches.		Same as Type 1.
Superstructure	Timber decking on six timber road bearers.	Timber decking on nine timber road bearers.	
Track width	8 feet 6 inches.		Same as Type 1.
Bay length	22 feet 1½ inches.		Same as Type 1.

(5) *Heavy ponton and trestle equipment* (Brückengerät B). This is the standard combat equipment of the German Army.

Detail	Type 1	Type 2	Type 3	Type 4
Type of bridge	Roadway spanning from center of ponton to center of ponton. Whole ponton piers.	Two pier rafts on half pontons.	Two pier rafts on whole pontons.	Two pier rafts on whole pontons.
Capacity	4.5 tons.	10 tons.	10 tons.	20 tons.
Floating units	Non-reversible steel or alloy pontons with upswept bows.			
Length	49 feet 11 inches.	24 feet 11½ inches.	49 feet 11 inches.	
Beam	5 feet 9 inches.		5 feet 9 inches.	
Superstructure	Steel 1 section road bearers with single timber decking.			12 road bearers with double decking and double raft connectors.
Track width	All types: 8 feet 6 inches.			
Bay length	All types: 20 feet 9 inches.			
Capacity of Divisional Bridge Column	400 to 430 feet.	250 feet.	250 feet.	170 feet.



Figure 95.—Small pneumatic boat.



Figure 96.—Track bridge and medium pneumatic boat.

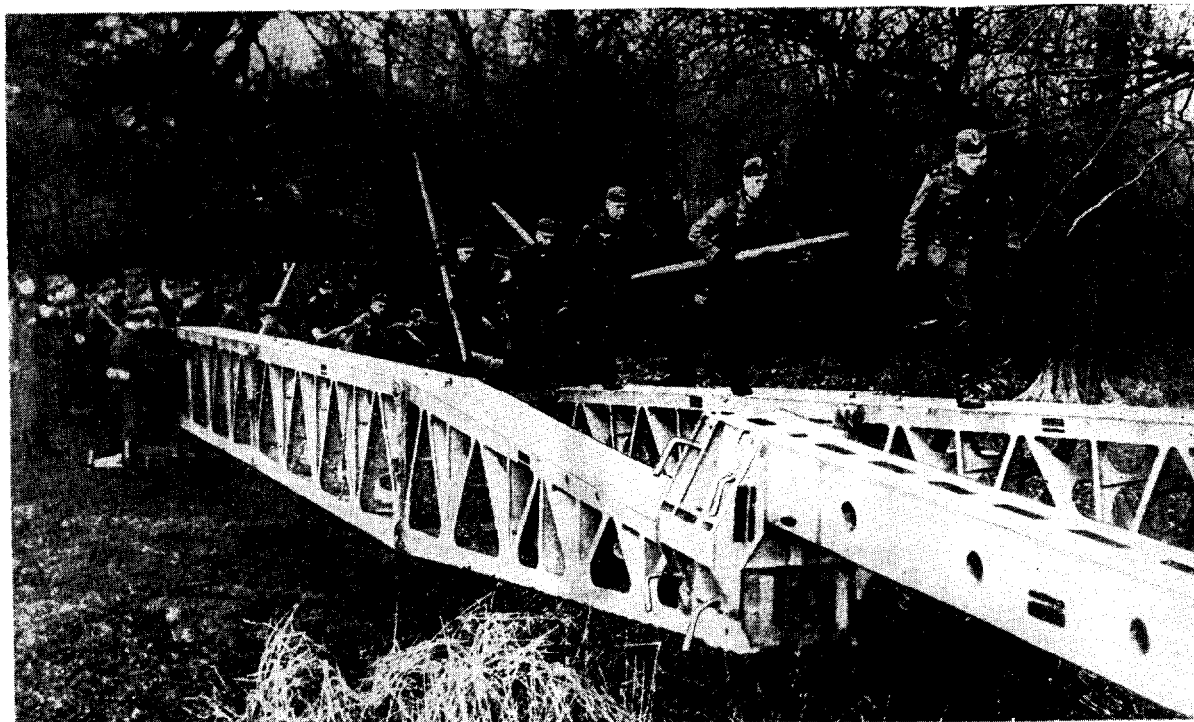


Figure 97.—K Bridge.

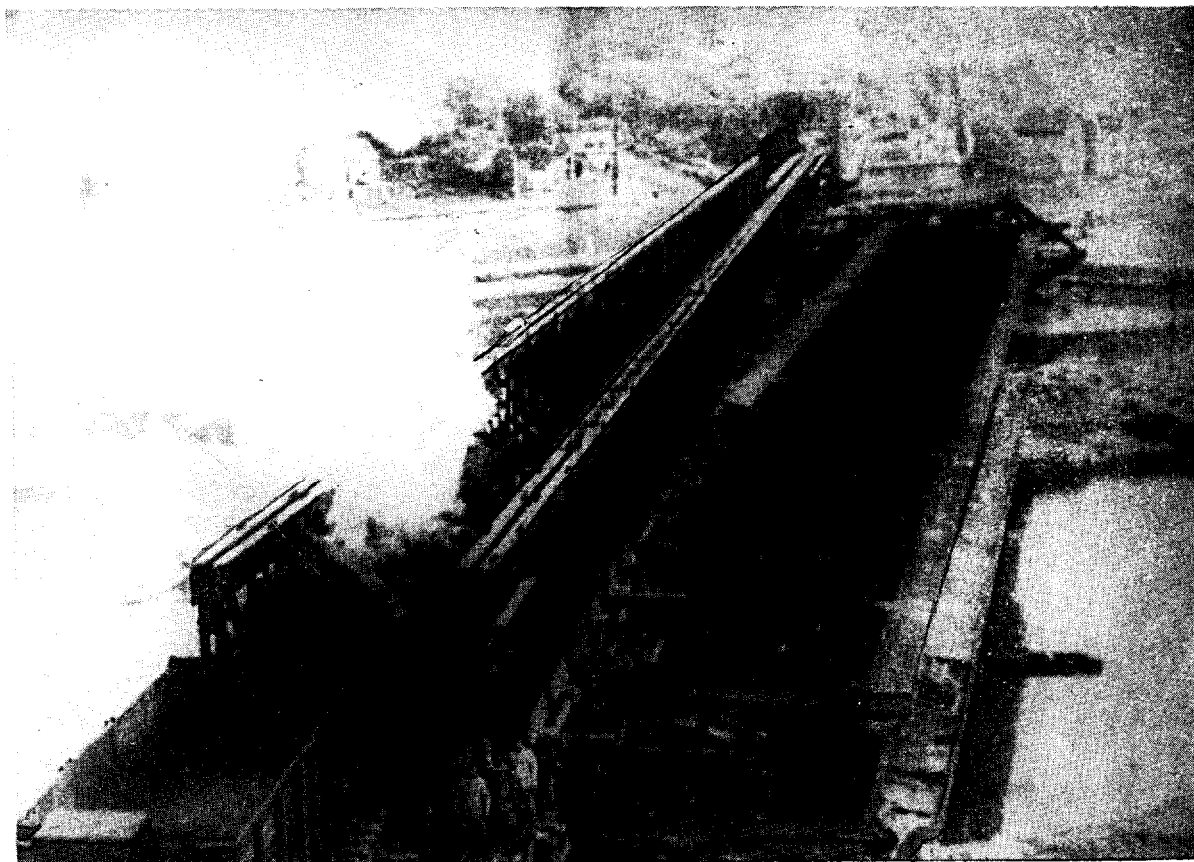


Figure 98.—L.Z. Bridge.

(6) *Light timber bridges on fixed supports.*

(a) *Folding single span foot bridges.* This equipment is made up of two single members, hinged together, and consisting each of two 3-inch round timber roadbearers supporting three cross bearers to which are wired two planks (9 foot 10 inches by 10 inches by 3½ inches. This bridge is trussed by means of a timber strut a short distance off center and a system of ties. The total length of the bridge is 19 feet 8 inches.

(b) *Light tracked bridge.* This is a light tracked timber bridge, constructed in two load ratings: 6 tons and 9.5 tons. It generally is supported by simple framed trestles, but if floating supports are needed the large pneumatic boat is used. The following tables give the cross sections of the roadbearers for varying spans and loads:

	Span		
Bridge	13 feet	16 feet 6 inches	20 feet
6-ton	7 x 7 inches	8 x 7 inches	9 x 8 inches.
9.5-ton	8 x 8 inches	9½ x 8 inches	10½ x 9½ inches.

(7) *27-Ton heavy tracked bridge.* (a) *Description.* This bridge is a variation of the light

tracked bridge, with a capacity of 27 tons, it consists of two bays and a span of 29 feet 6 inches. A single bent framed trestle is used as a central support.

(b) *Components.*

Bridge seats:

Length13 feet.
Width11 inches.
Depth8 inches.

Ramps:

Length5 feet.
Width4 feet 9 inches.

Roadbearers:

Length14 feet 9 inches.
Width7 inches.
Depth9½ inches.

Track section:

Length4 feet 11 inches.
Width over-all.....4 feet 9 inches.
Useful width.....4 feet 3 inches.

Trestle:

Capsill and

Groundsill:

Length13 feet.
Width7 inches.
Depth8½ inches.

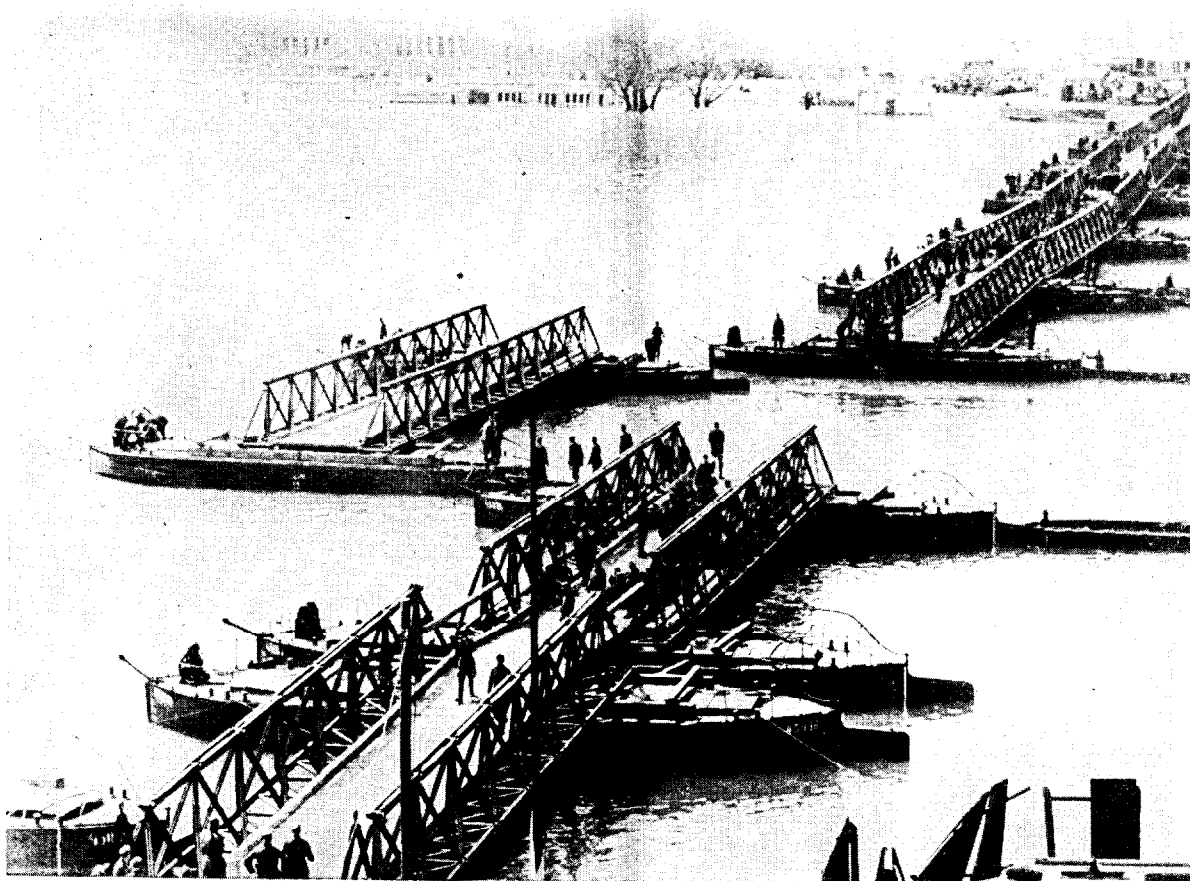


Figure 99.—Herbert Bridge.

d. FIXED BRIDGES. (1) *Small box girder (Brückengerät K)*. This equipment is capable of carrying heavy vehicles and light tanks over short gaps. It is essentially an assault bridge and can span gaps of 31 feet 6 inches, 47 feet 3 inches, or 63 feet with box girders alone. The bridge always is built with three girders and has a carrying capacity of 27 tons. Trestles and pontons are supplied to span wet or dry gaps with a series of bridges.

(2) *Light sectional bridge (Leichte Z Brücke)*. This is a through bridge with a timber roadway, approximately 12 feet wide, slung between two main girders of braced steel panels 8 feet 2 inches long and 7 feet 10 inches high. The normal bridge cannot span a gap greater than 147 feet 6 inches, and is rated over this and all lesser spans at 33 tons for tanks. With special underslung bracing the span may be increased to 172 feet without altering its rating.

(3) *Herbert Bridge*. This bridge is sometimes called the "Italian Meccano Bridge". It is through-girder type with a 10-foot clear roadway. Each girder is constructed of steel lattice pyramids, made of angle iron and channel struts. The decking is of 6-inch timber plank. The German classification of this bridge is 18 tons over 82 feet. This bridge also may be used in conjunction with trestles or pontons.

e. HEAVY BRIDGING EQUIPMENT. *J 42 and J 43 Bridging Equipment (Brückengerät J 42 and J 43)*. The *J 42* equipment consists of steel box-girder sections, of which any number up to four can be bolted together to form a maximum span of 64 feet. Each section is about 16 feet 6 inches long. A decking of stout chesses is laid on these main bearers and held down by two similar box girders used as vibrants. The girders are launched over rollers. Trestles and four-section pontons are used as supports. The single track width of the bridge is believed to be 13 feet 9 inches, but it also can be constructed in double track width. The *J 43* bridge is a strengthened version of the *J 42*.

9. Mechanical Equipment

a. 6-TON MOBILE CRANE (*Sd. Kfz. 9/1 (Drehkran Kraftwagen 6 t.)*). This crane is mounted on the chassis of the 18-ton semi-tracked vehicle (*Sd. Kfz. 9*). It has a telescopic jib mounted on a ball-bearing base, which permits a traverse of 180 degrees and an adjustment for ground slope up to 12 degrees in any direction.

The jib has two radii of operation according to the lifting capacity: 6 tons for the smaller radius and 4 tons for the larger radius.

b. WIRE CUTTERS. (1) *Large type*. These cutters are approximately 2 feet in length and weigh 5 pounds. The two jaws of special steel are pivoted on two links and operated by a pair of tubular steel handles. These are hinged together and covered with insulated grips which are secured by terminal caps and locking rings. A short pin acts as a stop.

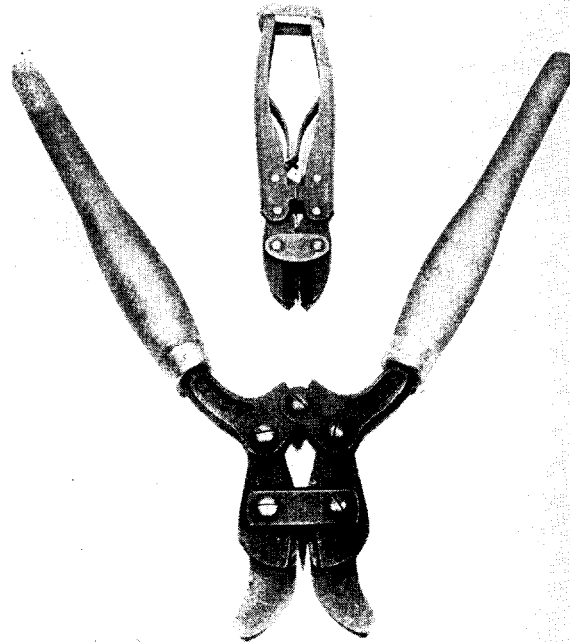


Figure 100.—Wirecutters.

(2) *Small type*. These cutters are 1 foot 4 inches long and weigh $2\frac{3}{4}$ pounds. There are minor variations in construction among samples manufactured by different firms. The general design is similar to that of the large cutters, but the shape of the jaws is different, one jaw being bent over in the form of a hook to aid in holding the wire. The handles have insulated grips.

c. BLAST DRIVE ROD. This equipment is designed for the rapid production of small diameter vertical holes in the ground for telegraph poles or similar supports. The equipment includes a drive rod; two tubular hand levers; a long, thin, metal rod; and a propellant charge, safety fuze, and igniter.

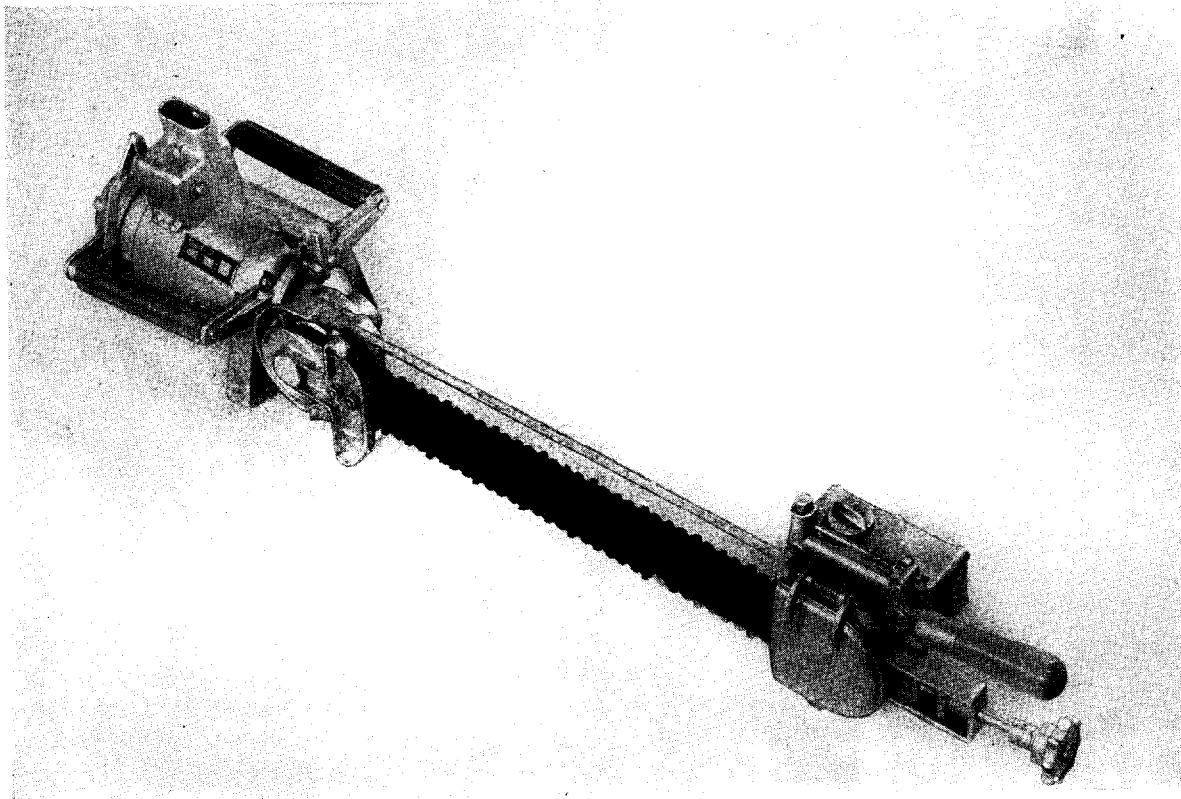


Figure 101.—Electric chain-saw.

d. GERMAN PORTABLE POWER SAWS. (1) *Light power saw.* (a) *Description.* The main components are the gasoline motor with its gearing, the clutch, saw blade, and saw chain. The saw blade can be turned through 90 degrees for horizontal or vertical cutting and is locked in position by a lever.

(b) *Characteristics.*

Weight including fuel..111 pounds.
Effective length of
blade3 feet 3 inches.
Revolutions per minute..2,600.
Speed of cutting chain..21 feet per second.
Fuel consumption.....1¼ to 2½ pints per hour.

(2) *Heavy power saw.* (a) *Description.* This is similar to the light power saw. It is too heavy for hand use and is provided with three adjustable legs and a large bogie for wheeling into position. The saw blade can be swivelled about the axis of the chain drive wheel, as well as vertically or horizontally.

(b) *Characteristics.*

Weight including fuel..172 pounds.
Effective length of
blade3 feet 3 inches.
Revolutions per minute..2,300.
Speed of cutting chain..23 feet per second.
Fuel consumption.....2½ to 3 pints per hour.

e. ELECTRIC GENERATORS AND ELECTRIC POWER TOOLS. (1) *Field generating set.* (a) *Description.* This field generating set is used by German army engineers in mobile workshops for power driven tools. It is also used for charging storage batteries.

(b) *Characteristics.*

DesignationMaschinensatz 220/380.
Weight507 pounds.
Motor2 cylinder, 2 stroke.
Type of generator....AC.
Kilowatts6.
Volts220/330.

(2) *German electric two-speed drill.* This machine is used for boring holes in the construction of improvised bridges. The drill normally uses its own detachable mounting but, for boring wood, it may be held by hand. The drill consists of a 50-cycle AC motor, consuming 800 watts, fitted with a Morse taper sleeve and a two-speed gear box giving 200 to 400 revolutions per minute.

f. GERMAN PILE DRIVERS. (1) *Field Pile-Driving Frame 1930.* (a) *Description.* This equipment consists of a guide mast with a double block at the top, supported on a base by two

back stays. For pile-driving from land the frame is mounted on four wheels. These wheels are replaced by beams when pile-driving is carried on from a raft. A two-drum, hand winch serves to raise and lower the pile driver. The following can be operated on the frame:

(b) *Characteristics.*

Three-piece hand-operated monkey.....440 foot pounds.
Compressed air pile driver360 foot pounds.
Compressed air pile driver1,440 foot pounds.
Diesel pile driver.....992 foot pounds.
Diesel pile driver.....1,323 foot pounds.

(2) *Pneumatic pile driver (360 foot pounds).*

(a) *Description.* The main components are a stationary part, consisting of the piston, piston rod, and piston base; a moving part (monkey) consisting of driving block, cylinder, and screw-in cylinder head; a spring-loaded clamping device, and a guide for use with the pile-driving frame 39. The driver is the fast hitting type and attains its high rate because the acceleration of the moving portion is due not only to its own weight but also to the compressed air operating downwards on an internal flange at the base of the bore of the cylinders.

(b) *Characteristics.*

Weight of monkey.....121 pounds.
Cylinder base.....2.5 inches.
Stroke1 foot 5 $\frac{3}{4}$ inches.
Force per blow.....360 foot pounds.
Striking rate.....105 per minute.

(3) *Pneumatic pile driver (1,440 foot pounds).*

(a) *Description.* This pile driver is similar to the lighter one, but it has a heavier monkey and a longer stroke. This driver is the free falling type. The monkey is lifted up by compressed air, falls freely onto the base plate, and gives up its kinetic energy to the pile after covering a stroke of little more than a yard.

(b) *Characteristics.*

Weight of monkey.....448 pounds.
Cylinder base.....3 $\frac{9}{16}$ inches.
Stroke3 feet 3 $\frac{1}{2}$ inches.
Force per blow.....1,440 foot pounds.
Striking rate.....54 per minute.

(4) *Diesel pile driver (992 foot pounds).*

(a) *Description.* The main components are the piston with anvil, the monkey, the guide tubes, the headpiece, and the fuel tank. This diesel pile driver works on the two-stroke principle: an explosion takes place on each hitting stroke.

The required ignition temperature is reached through the compression of the air trapped between the top of the falling piston and the monkey.

(b) *Characteristics.*

Weight of monkey.....980 pounds.
Total weight.....2,100 pounds.
Stroke4 feet 7 inches.
Striking rate.....50 per minute.

(5) *Heavy diesel pile driver.*

(a) *Characteristics.*

Weight of monkey.....1,100 pounds.
Cylinder base.....8 $\frac{1}{2}$ inches.
Stroke7 feet 2 $\frac{5}{8}$ inches.
Energy per blow.....8,255 foot pounds.
Striking rate.....50 per minute.

g. WATER SUPPLY AND WATER PURIFICATION.

(1) *Portable haversack filter.* This filter, issued on a company basis, is a standard item of equipment in the German Army. Performance is said to be from 22 to 55 gallons of water per hour, according to the amount of solid matter in suspension. Although the action of the filter is purely one of clarification, it is claimed by the Germans that it effectively will treat "naturally" contaminated water, that is water in which corpses

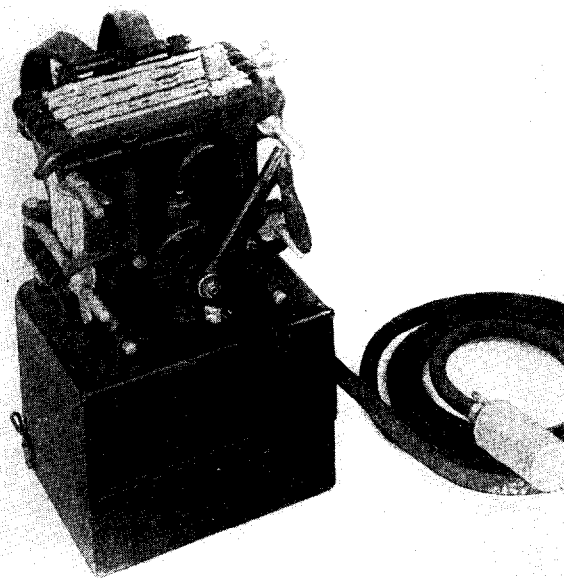


Figure 102.—Haversack water filter.

have been lying. However, it will not rid the water of objectionable smell, nor is it effective against water containing chemical agents or substances in solution.

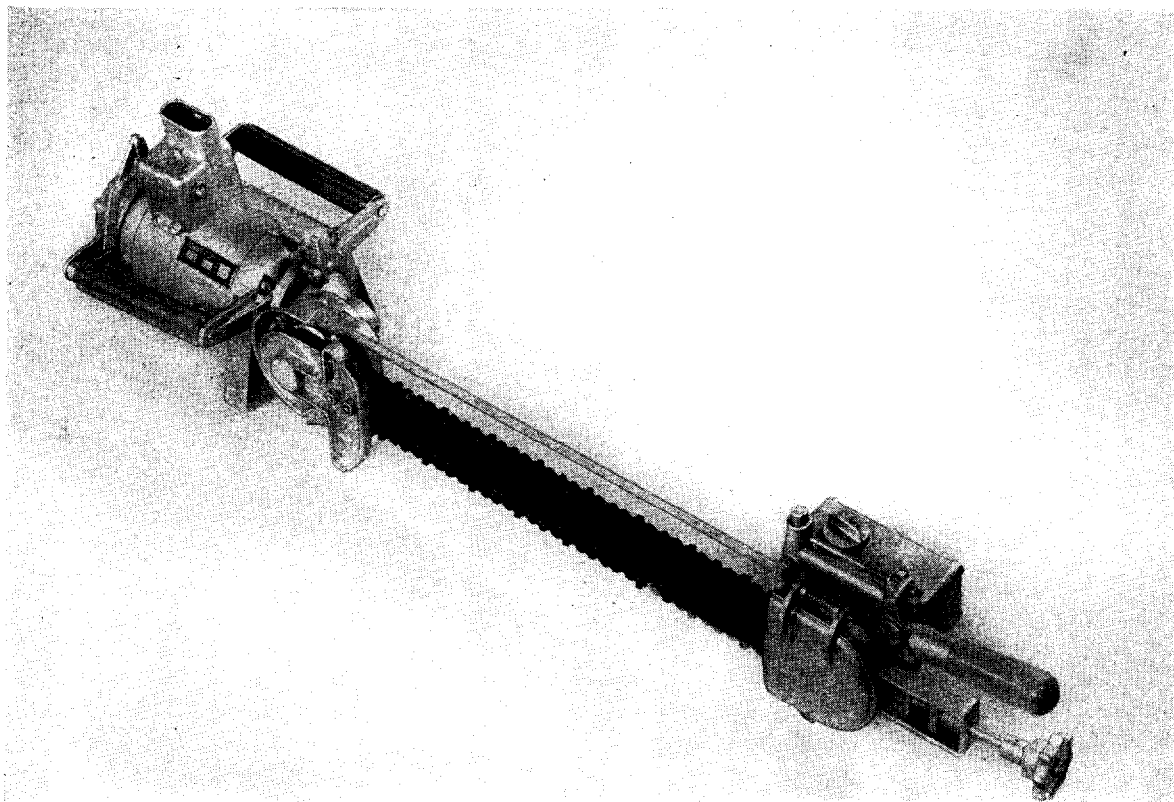


Figure 101.—Electric chain-saw.

d. **GERMAN PORTABLE POWER SAWS.** (1) *Light power saw.* (a) *Description.* The main components are the gasoline motor with its gearing, the clutch, saw blade, and saw chain. The saw blade can be turned through 90 degrees for horizontal or vertical cutting and is locked in position by a lever.

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Weight including fuel..111 pounds.

Effective length of

blade3 feet 3 inches.

Revolutions per minute..2,600.

Speed of cutting chain..21 feet per second.

Fuel consumption.....1¾ to 2½ pints per hour.

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Weight including fuel..172 pounds.

Effective length of

blade3 feet 3 inches.

Revolutions per minute..2,300.

Speed of cutting chain..23 feet per second.

Fuel consumption.....2½ to 3 pints per hour.

e. **ELECTRIC GENERATORS AND ELECTRIC POWER TOOLS.** (1) *Field generating set.* (a) *Description.* This field generating set is used by German army engineers in mobile workshops for power driven tools. It is also used for charging storage batteries.

(b) *Characteristics.*

DesignationMaschinensatz 220/380.

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Motor2 cylinder, 2 stroke.

Type of generator.....AC.

Kilowatts6.

Volts220/330.

(2) *German electric two-speed drill.* This machine is used for boring holes in the construction of improvised bridges. The drill normally uses its own detachable mounting but, for boring wood, it may be held by hand. The drill consists of a 50-cycle AC motor, consuming 800 watts, fitted with a Morse taper sleeve and a two-speed gear box giving 200 to 400 revolutions per minute.

f. **GERMAN PILE DRIVERS.** (1) *Field Pile-Driving Frame 1939.* (a) *Description.* This equipment consists of a guide mast with a double block at the top, supported on a base by two

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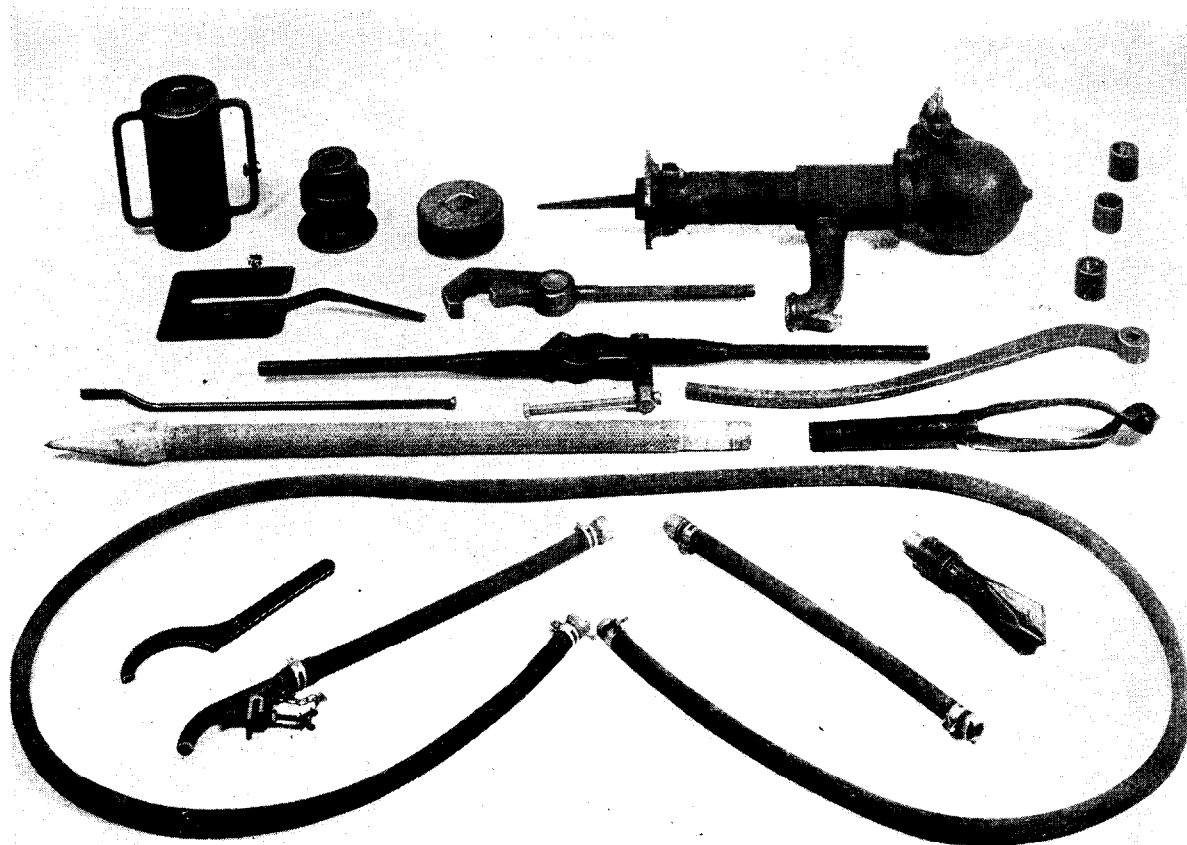


Figure 103.—Tube well set with accessories.

(2) *German Tube Well 1937 Pattern, with Accessories "A" and "B".* This tube well is a suction pump capable of lifting water from a depth of 26 feet. Accessory "A" extends the depth to about 33 feet. Accessory "B" permits the pump to be used for pumping surface water.

h. MARKINGS OF CYLINDERS OF INDUSTRIAL GASES. The Germans always stamp the type of gas their cylinders contain into the metal itself as guide in case the paint should change color or disappear through weathering.

Cylinder color	German name	English name
Red	Wasserstoff	Hydrogen
Blue	Sauerstoff	Oxygen
Green	Stickstoff	Nitrogen
Yellow	Acetylen	Acetylene
Gray (with red band)	Propan	Propane
Gray	Pressluft	Compressed air
Not given	Kohlen Säure or Kohlen Dioxid	Carbon dioxide
" "	Schwefel Dioxid	Sulphur dioxide
" "	Chlormethyl	Methyl chloride

i. EARTH MOVING EQUIPMENT. *Trench plows.* Small and large trench plows are used by the German Army. The small trench plow consists of a double plowshare on the hooked end of a girder which is supported on a two-wheeled trailer and towed behind a semi-tracked vehicle. The large plow consists of the plow, anchor, pulley assembly, tow wire, and support.

j. AIR COMPRESSORS AND PNEUMATIC TOOLS. (1) *Sinker rock drills.* There are two types of sinker rock drills used by the German Army: the "D" handle and the "T" handle types. Both, judged by American standards, fall into the light-weight class (40 to 50 pounds). These tools are similar in design but the internal parts are not interchangeable. Both of these rock drills can be used by attaching American standard air lines with the universal coupling used on the German drills.

(2) *German F.M.I. Air Compressor.* (a) *Engine.* This is a four-cylinder gasoline engine with magneto ignition. The horsepower rating is

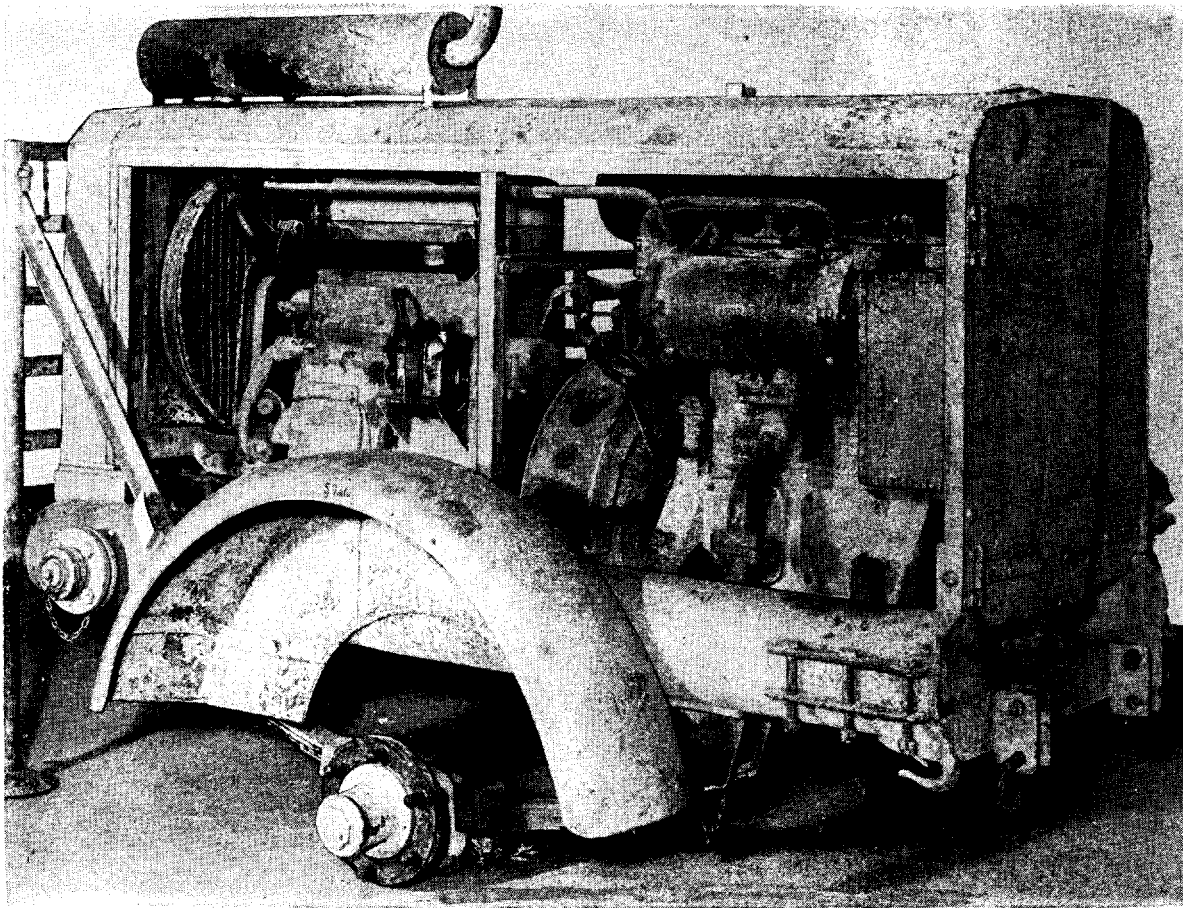


Figure 104.—F.M.A. Air Compressor.

27 at 950 revolutions per minute. The main shaft is connected to the compressor by a single disc clutch with a rotating collar and a manual engaging lever. There are two water pumps, one attached to the engine and one to the compressor.

(b) *Compressor.* The compressor is a two-cylinder, single-stage mechanism. The operating

pressure is presumed to be approximately 90 pounds per square inch. The air tank is of unusual design. It consists of three short sections of steel tubing welded into a "V" shape with the open ends sealed off. This air tank is used as the base for mounting the engine and compressor.

Section VI. CHEMICAL WARFARE EQUIPMENT

I. General

The German military organization is thoroughly prepared for chemical warfare. Germany's chemical industry is highly developed; equipment and stocks of war gases in storage and production are ample, and adequate well trained personnel are available. Offensively or defensively, the German Army is in a position to wage chemical warfare at any time. Unusual activity in research and manufacture has taken place in German chemical plants since the beginning of the war, and from time to time movements of war gases from one area to another have been reported. Military depots are believed to be amply stocked with gas shells of all calibers. Construction of anti-gas shelters in German cities, issue of gas masks to civilians, and a constant examination and replacement of gas mask canisters have been regularly carried out.



Figure 105.—German gas mask, GM 30.

2. Defensive Equipment

a. GAS MASKS. (1) *General*. Most German gas masks are of the snout type, in which the canister is connected directly to the facepiece. Types GM 30 and GM 38 are in general use, and in addition to the standard masks there are several special types. Generally, German gas masks provide good protection against the common war gases, and fair protection against such gases as arsine, hydrocyanic acid, and cyanogen chloride. The Germans also have three types of gas masks for horses and one for dogs.

(2) *Gas mask, GM 30*. The facepiece is of four-layer, field gray fabric, with a suede leather fitting band, a leather chin support, and plastic eyepieces. The head harness has seven points of attachment. There is a cotton strap for suspending the mask from the neck in an alert position. Some GM 30 facepieces are fitted with an adapter for microphone.

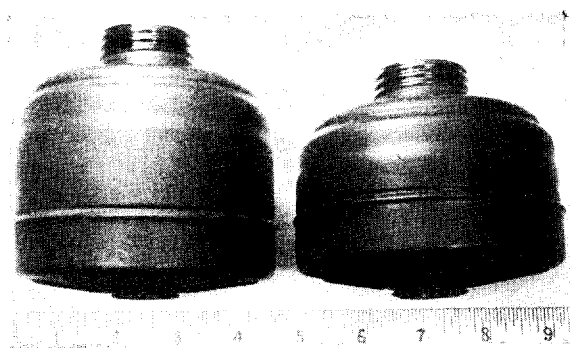


Figure 106.—German FE 41 and FE 42 Canisters (larger is the FE 42).

Canisters normally used with this mask are the FE 41 and the FE 42. The FE 41 canister is drum-shaped and painted green. It measures $2\frac{1}{2}$ inches by $4\frac{1}{4}$ inches in diameter and weighs 11.9 ounces. It is being replaced by the FE 42, the canister of which is the newest and most efficient of the service canisters. Externally, it is similar to the FE 41, but is larger and heavier, measuring $3\frac{1}{2}$ inches high by $4\frac{1}{4}$ inches in diameter, and weighing 16.3 ounces.

The standard carrier is a corrugated cylindrical metal case with a hinged cover and cotton carrier straps. It is painted drab, field gray, or blue-gray. Parachutists are provided with a padded, canvas, satchel-type carrier, having a snap fastener at the top and a zipper along one side.

(3) *Gas mask, GM 38*. This mask began replacing the GM 30 in 1938. It is similar in de-

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sign, but the facepiece, made of synthetic rubber has a rubber fitting band and a simpler head harness with only five points of attachment. The same canisters and carrier are used with this mask as with the *GM 30*.

(4) *Gas mask, cavalry*. The facepiece is of conventional German construction, similar in most respects to that of the *GM 30*. It has a hose-tube assembly, approximately 17 inches long, for connecting canister to facepiece. The brownish-gray canister has a generally elliptical cross-section, and measures $8\frac{1}{2}$ inches high by $4\frac{7}{8}$ inches by $2\frac{1}{4}$ inches. Its weight is 27.7 ounces. The facepiece carrier is lightweight duck, and measures 20 inches long by 8 inches wide at the upper end. Its sides are tapered to a width of about 3 inches throughout the 9-inch hose portion. The canister carrier, of dark brown saddle leather, fits snugly over the canister and is attached to the lower end of the facepiece carrier.

(5) *Gas mask, optical*. The facepiece, made of leather, has round, glass eyepieces, held in place by screw-type adapters. The interpupillary distances of eyepieces may be varied by means of an adjustable screw. A hose tube connects the facepiece to the canister which is carried over the shoulder. In the left cheek of the facepiece is an adapter for a microphone. Standard canisters, as well as carbon monoxide canisters, may be used with this facepiece. The carrier is a rectangular metal box.

(6) *Gas mask, oxygen breathing set*. This is a self-contained, oxygen-breathing apparatus, effective for somewhat over an hour. The facepiece is of the usual service type. The carrier is a metal knapsack, designed to rest on the user's back. It contains an alkali canister, an oxygen bottle, a valve, and a breathing bag with two breathing tubes, an "in" and an "out". The mechanism operates automatically on breathing. The apparatus is designed for use in cellars, dug-outs, gun turrets, and ship holds in the presence of high concentrations of toxic gas, such as carbon monoxide.

(7) *Plastic emergency breathing device*. This is an emergency breathing device enabling a canister to be used without a facepiece. Made of either transparent or yellow plastic, it consists of a circular piece to which are attached a tube for mouthpiece and a T-bar for chin rest. The circular piece is threaded internally to receive standard German canisters. A nose clip is at-



Figure 107.—German gas mask, *GM 38*.

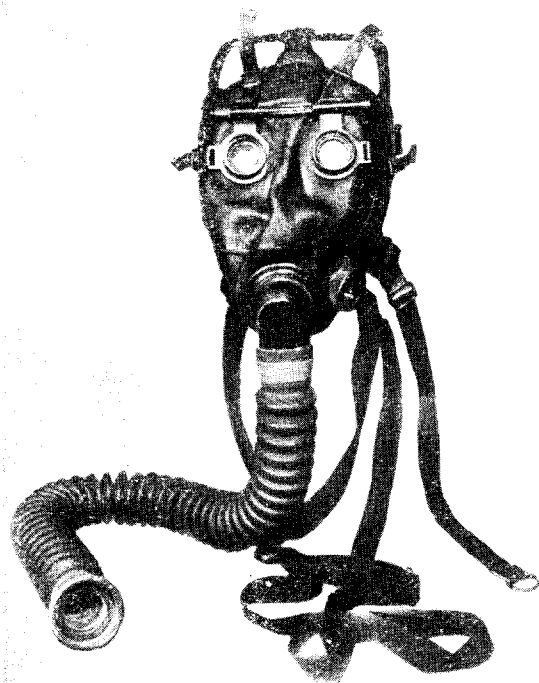


Figure 108.—German optical gas mask.

tached to the circular piece by a cord, which also may serve to hold the device in an alert position. Apparently intended for protection against rapidly acting gases in sudden concentration, it can be put into use in less than 5 seconds. Its existence may partly explain why the German soldier is supposed to carry a spare canister.

(8) *Gas mask, combat engineers.* This is a leather helmet, with a leather drop curtain fitted with eyepieces. The curtain normally is rolled up, but it may be dropped quickly over the face and held in place by a tape tied around the back of the head and neck. Flat filters cover the nose and mouth, possibly to provide limited, but speedy, protection against transient high gas concentrations. The face also would be protected against incendiary or corrosive materials.

(9) *Gas mask, headwound.* Designed for men with headwounds, this is a hood made of sheet rubber, with one oval window large enough to see out of with both eyes. It is provided with inlet and outlet valves and a fitting to receive the standard canisters. The carrier is a metal case.

(10) *Gas mask, carbon monoxide.* The Germans have several types of special canisters which provide very good protection against carbon monoxide. These canisters are attached to the normal facepieces by means of long hose-tubes. The canisters normally are larger and heavier than the standard canisters. An example is the CO FB 38 canister, measuring 11 inches high by 5 inches in diameter and weighing 5.2 pounds.

(11) *Gas mask, horse.* (a) *Model 38.* This is a black rubber facepiece which fits over the nostrils and upper jaw. The bottom of the facepiece is reinforced to provide a biting pad. On

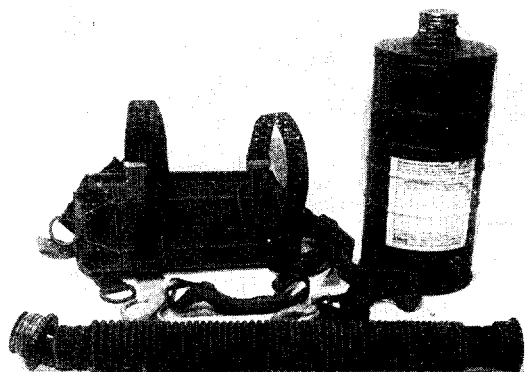


Figure 109.—German CO FB 38 Canister for protection against carbon monoxide.

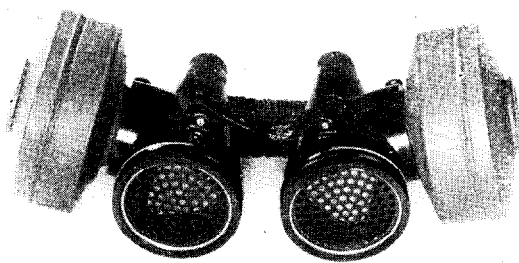


Figure 110.—German horse gas mask, PFE 41.

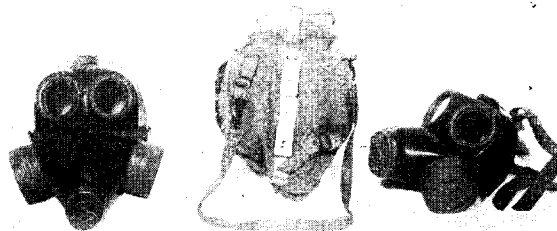


Figure 111.—German dog gas mask 41.

each side of the facepiece is a canister, and on the front is an outlet valve. Near the top of each side, in the rear of the facepiece, are two heavy metal buckles for attaching the head harness. The canister, drum-shaped and painted green, measures approximately 2.1 inches high by 5 inches in diameter.

(b) *Model 41.* This consists of a pair of hollow cones with large slots near the apex, each with an outlet valve in the base and a threaded side opening into which a flat canister is screwed. The cones are placed up the nostrils of the horse and held in place by a harness over the head.

(c) *Damp mask, Model 41.* This consists of a large paper-fabric bag with padded lip and biting pad to fit over the upper jaw. Before it is used, the mask must be impregnated with a special salt solution.

(12) *Gas Mask 41, dog.* The facepiece, of a black, rubber-like compound, is made in four sizes. It has circular eyepieces, a valve assembly in the nose, and a canister on each side. The head harness consists of a throat strap, a fastener strap, and four head straps. The valve assembly consists of an air inlet knob and an outlet valve. The canister of thin green-painted metal, is 2 inches high by 3 1/4 inches in diameter. The carrier is a brown canvas haversack with a shoulder sling.

b. PROTECTIVE CLOTHING. (1) *General*. For troops there are the impermeable light and heavy protective suits and several types of protective capes. No impregnated clothing has been reported. There are leggings and protective covers for horses, and leggings and gas clothing for dogs.

(2) *Light protective suit*. This suit consisting of boots, shorts, gloves, and a neck cover, is made of a fabric coated with a synthetic rubber (opanol). Components of the normal suit vary in color from grayish-green to dark blue-gray, with light tan or khaki for tropical use. Boots are rubber soled. The gloves are of either elbow or shoulder length. In some cases shorts have a bib in front. When deemed necessary, an extra pair of shorts may be used to protect the upper part of the body. The suit is carried in a small case of the same material.

(3) *Heavy protective suit*. This comprises a jacket with hood, pants of the over-all type, gloves, and boots. Jacket and pants are made of fabric coated on both sides with gray rubber. Boots of knee length, are of heavy black rubber. Gloves are of gray or black molded rubber.

(4) *Protective sheet*. This rectangular sheet is approximately 78 inches long and 48 inches wide. It may be made of paper, opanol-coated fabric, or nylon.

(5) *Eyeshields*. Made of celluloid-type material, these consist of four separate sections sewed together to form an eyeshield with side panels. The eyeshield—two amber or green and two colorless—are carried in a green fabric case.

(6) *Horse cover*. Made of an impermeable opanol-coated fabric, black inside and tan outside, this cover is in two halves, one for the right side and one for the left. Each half is rectangular, 62 inches long and 45 inches wide. On the front end is a sleeve-like projection of double thickness to fit over the leg. The cover is designed to protect the underbelly parts of the horse.

(7) *Horse legging*. Sleeve-like in shape, of gray or green rubberized fabric, it is made in two sizes to fit front and hind legs.

(8) *Horse goggles*. These comprise a pair of plastic eyepieces trimmed with leather, held together by an adjustable cloth strap, with another cloth strap attached to the outside of each eyepiece. A red line on one eyepiece, and a blue line on the other, apparently are to mark the right and left eyepieces.



Figure 112.—Gloves, German heavy protective clothing.

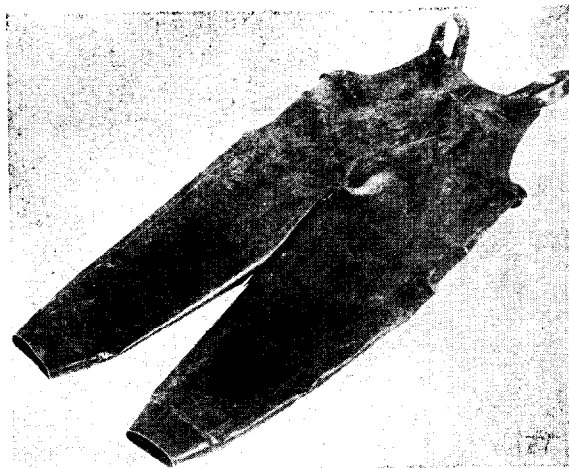
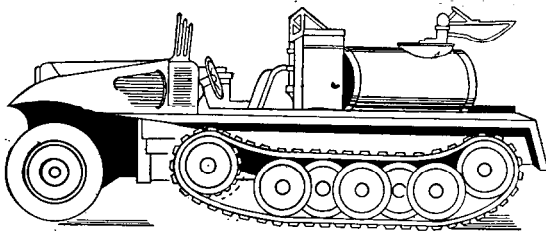


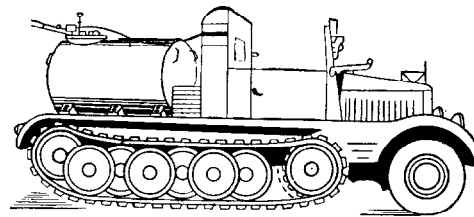
Figure 113.—Pants, German heavy protective clothing.



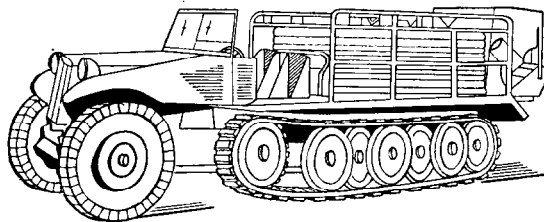
Figure 114.—Jacket, German heavy protective clothing.



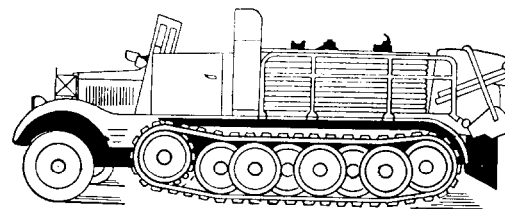
LIGHT BULK CONTAMINATION VEHICLE
(Sd. Kfz. 10/3)



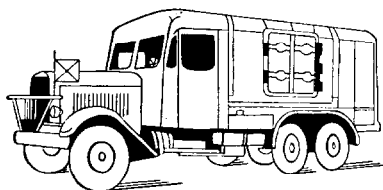
MEDIUM BULK CONTAMINATION VEHICLE
(Sd. Kfz. 11/3)



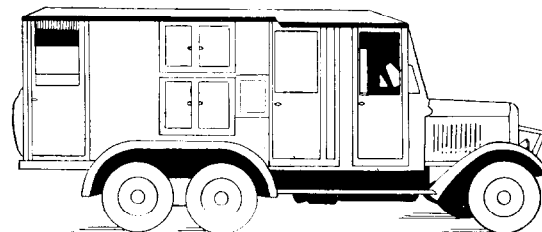
LIGHT DECONTAMINATION VEHICLE
(Sd. Kfz. 10/2)



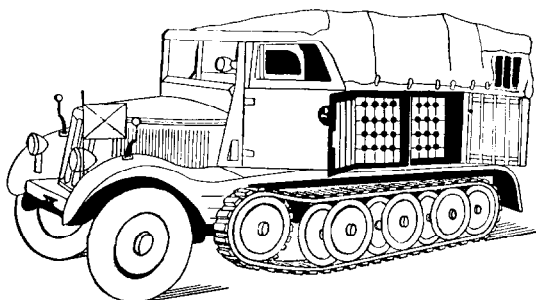
MEDIUM DECONTAMINATION VEHICLE
(Sd. Kfz. 11/2)



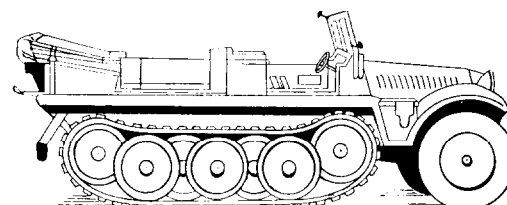
VEHICLE FOR DECONTAMINATION OF CLOTHING
(Kfz. 93)



VEHICLE FOR DECONTAMINATION OF PERSONNEL
(Kfz. 92)



SMOKE VEHICLE (Sd. Kfz. 11/1)



GAS-DETECTION VEHICLE (Sd. Kfz. 10/1)

Figure 115.—Decontamination vehicles.

(9) *Gas Clothing 41 for dogs.* This consists of a hood and suit, to which are sewed rubber footcovers. Suit and hood are made of thin, field-gray, impregnated fabric. The suit, made in three sizes, is carried inside the facepiece of the dog gas mask.

(10) *Dog Legging 41.* This is made of rubber in only one size and consists of foot and leg parts, fitted with fastening straps.

c. DECONTAMINATION. (1) *Equipment.* (a) *Mobile decontamination plant.* This plant for the decontamination of clothing and equipment may take the form of motor trucks mounting a water-tube boiler for the rapid generation of steam, a steam chamber, and a drying chamber.

(b) *Vehicle for decontamination of personnel.* A six-wheeled motor vehicle fitted with a large box body which contains bathing facilities for 150 men per hour. Completely equipped, it weighs about 9 tons.

(c) *Vehicle for decontamination of clothing.* A six-wheeled vehicle fitted with a large closed body which is equipped with a boiler, fans, and water tanks. Completely equipped, it weighs about 9.7 tons.

(d) *Light decontamination vehicle.* This open, semi-tracked, 1-ton motor vehicle, equipped with a distributing hopper on the rear, carries about 1,675 pounds of bulk decontaminant and 16 decontamination canisters (22 pounds) for use by hand.

(e) *Filter for decontamination of water.* The apparatus consists of two parts: the filter proper and a tank containing water for cleaning the filter. Both are of sheet iron covered with enamel. The filter proper is a tall, cylindrical tank filled with activated charcoal.

(f) *Decontamination plow.* This is a large, fish-hook-shaped, ditching plow, mounted on a two-wheeled carriage with pneumatic tires. Over-all length is 11 feet 6 inches; over-all width is 6 feet 1 inch. The plow produces a furrow 20 inches wide.

(g) *Decontamination pump.* This is a metal stirrup pump, approximately 24 inches in length, with about 9 inches of rubber hose.

(h) *Decontamination canisters.* These canisters consist of metal cylinders, 6.7 inches high by 3.3 inches in diameter, and a quadrangular metal or cardboard container, 14.6 inches high by 8.2 inches wide. Each has a perforated screen in the top for sprinkling the contents, normally Losantin, on a contaminated surface.

(2) *Decontaminants.* (a) *Losantin.* This high quality, stabilized, white bleach powder is used for decontamination of standard blister gases. It is packed in steel drums of 55 and 110 pounds capacity.

(b) *Decontaminant 10.* This is a fine white or pale cream powder, packed in steel drums holding 132 pounds. Especially designed for nitrogen mustards, it is also a powerful decontaminant for all blister gases.

(c) *Decontaminant N.* A powdered or flaked white solid, supplied in wooden boxes of 175 pounds capacity, this is a substitute for Decontaminant 40, which is difficult and expensive to produce.

(d) *Weapon decontamination agent.* This individual issue is a small bottle of liquid agent in a dark brown, bakelite container. It is used for the decontamination of small arms and individual equipment.

(e) *Weapon decontaminating agent set.* This is a company issue. It consists of two bottles of liquid in a cardboard container 14 inches high by 4.7 inches in diameter. The red-capped bottle contains the decontaminating agent, and the black-capped bottle contains a substance to counteract the corrosion caused by the agent.

(f) *Horse decontamination canister.* A quadrangular cardboard box, with a perforated screen at one end, type 40 holds about 20 ounces of decontaminant. It is intended for a team of horses; type 41 which holds only about 10 ounces is designed for an individual horse. The canister is carried in the horse gas-mask carrier.

(g) *Dog decontamination canister 42.* This is a quadrangular cardboard box holding about 10 ounces of decontaminant.

d. PROTECTIVE AGENTS. (1) *Losantin.* Ten tablets of Losantin are issued in plastic boxes for

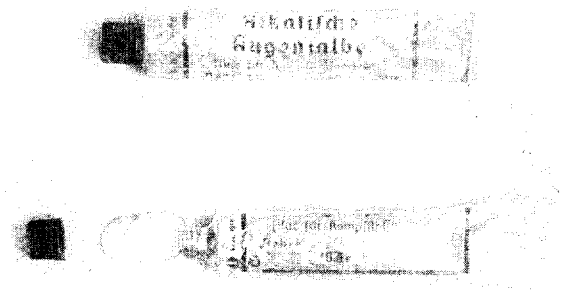


Figure 116.—German alkaline eye salve.



Figure 117.—German weapons decontaminating set, individual issue.



Figure 118.—German weapons decontaminating agent set, company issue.

decontamination of the skin. Adhesive strips of different colors indicate the year of manufacture. The issue is four boxes to a soldier, but reports state that it is being replaced by Protective Ointment 41.

(2) *Protective Ointment 41*. This is issued in bottles, with six swabs in an orange bakelite container, for decontamination of the skin.

(3) *Alkaline eye salve*. This is a creamy white salve in either a metal foil tube or a white jar. It is used for the treatment of eyes contaminated with blister gases.

(4) *Inhalant ampoules and swabs*. Five inhalant ampoules and six swabs are packed in a

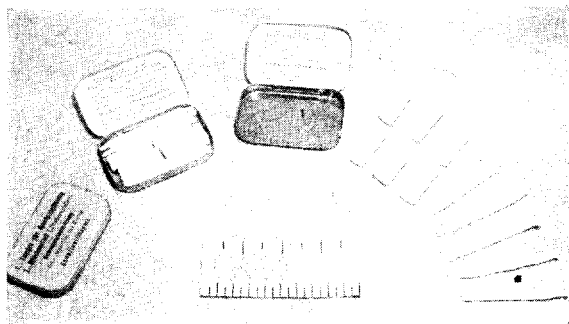


Figure 119.—German inhalant ampoules and swabs.

green metal box. The ampoules are for inhalation upon exposure to toxic smokes, and the swabs are for wiping off liquid blister gases.

c. GAS DETECTORS. (1) *Detector powder*. This is ochre or pink powder which changes color in contact with certain war gases in liquid form. The pink powder is reported to be obsolescent. Either a detector canister or a detector pump is used to spread the powder.

(2) *Carbon Monoxide Detector Paper 42*. Two bottles of testing liquid, 400 detector papers, and one holder for the detector paper comprise this set. When moistened with the testing liquid, the paper changes color in the presence of carbon monoxide.

(3) *Arsine detector paper*. This equipment is packed in a cardboard box, containing 100 bottles of detector paper and 30 holders for the detector paper. Each booklet which holds 10 sheets is inclosed in airtight packing. Arsine in the air changes the color of the paper.

(4) *Detector Canister 42*. This metal cylinder, with a perforated screen in one end, holds about 4 pounds of detector powder.

(5) *Gas detector*. This is for detection of gas vapors. It comprises an air-sampling pump

in a metal holder and five types of testing tubes in a metal carrier.

(6) *Carbon monoxide detector set*. (a) *Army type*. This consists of a field gray, wooden box, containing an air pump, 32 detector tubes, a tube holder, and accessories.

(b) *Commercial type*. Essentially, this consists of an air pump and detector tubes in a metal cylindrical carrier. Though a commercial detector, it is used in army fortifications. When air containing carbon monoxide is drawn through a tube from either set, the contents of the tube changes color.

(7) *Gas detector equipment set*. This consists of a metal carrier containing an air pump, a few detector tubes of each type, arsine detector paper, a small detector canister, and accessories.

(8) *Spray detector cards*. These stiff paper cards, packed 20 to a carton, are coated on both sides with a paint containing a dye which changes color in contact with liquid blister gases.

(9) *Detector powder pump*. This is a ribbed, sheet-metal box container having an internally

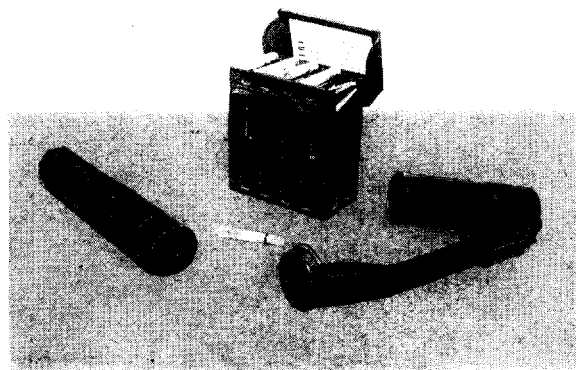


Figure 120.—German gas detector set.

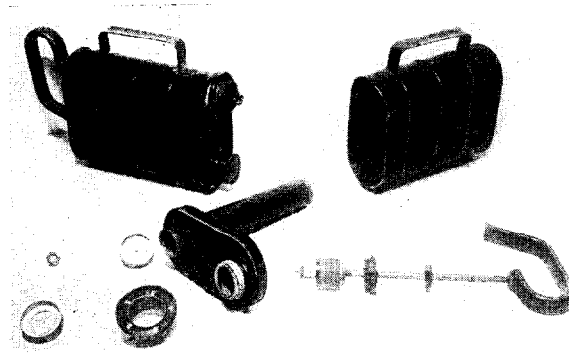


Figure 121.—German detector powder pump.

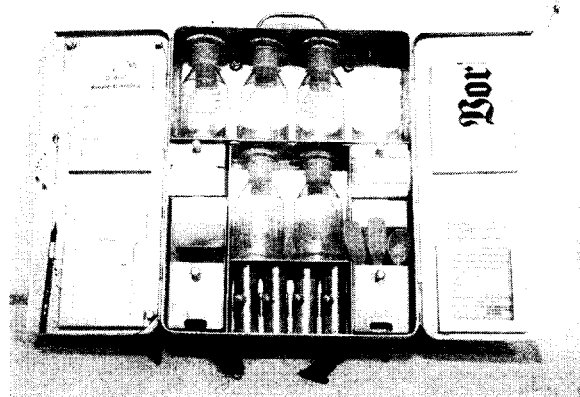


Figure 122.—German gas detector and sampling kit.

built pump, with a handle on one end and an adjustable spray nozzle on the other.

(10) *Gas detector and sampling kit.* This aluminum chest contains six sample bottles, four small detector canisters, war gas warning cards, spray detector paper, and accessories.

(11) *Detector paint.* This paint contains a dye which changes color in contact with certain liquid war gases. It is used to make smears on surfaces for detection of war gas spray.

(12) *Gas detector for fortifications.* A metal case contains an electric motor, air pumps, six pairs of metal and glass detector tubes, seatings for the tubes, and necessary connections for drawing air through all of the tubes at the same time.

(13) *Field laboratory.* This laboratory includes equipment for testing for war gases, in addition to necessary equipment for accomplishing its main function of food and drug analysis.

(14) *Gas detection vehicle.* This is an open, semi-tracked, 1-ton vehicle used for carrying gas detection personnel and their equipment.

f. MISCELLANEOUS. (1) *Ear plugs.* These are square tablets of yellow wax, packed six in a metal box, for protection of men with damaged ear drums.

(2) *Anti-dim disc.* This occurs in sets of two. The disc, 2.3 inches in diameter, has one side coated with gelatin. It is fitted over the inside of the eyepieces, with the gelatin-coated side next to the wearer's eyes. The gelatin rapidly absorbs moisture and prevents fogging of the eyepieces.

(3) *Anti-dim sheet.* This is an oval celluloid-type disc to fit over the window of a headwound gas mask to prevent fogging. The disc is believed to have one side coated with gelatin. Ten discs are packed in a tin box.

(4) *Gas mask tester.* This includes a rectangular chest containing an electric motor, a pressure gage, a head-form for the gas mask facepiece, and accessories.

(5) *Canister testing apparatus.* This is a portable tester in a wooden case. The case contains a pump, a canister resistance gage, and accessories.

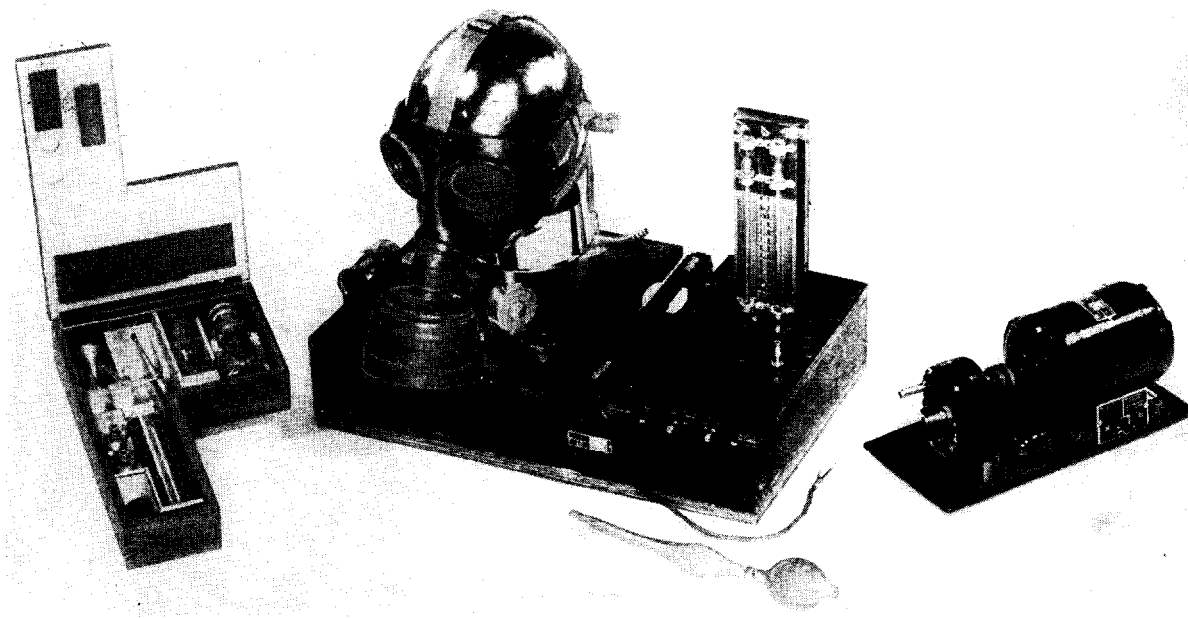


Figure 123.—German gas mask testing equipment.

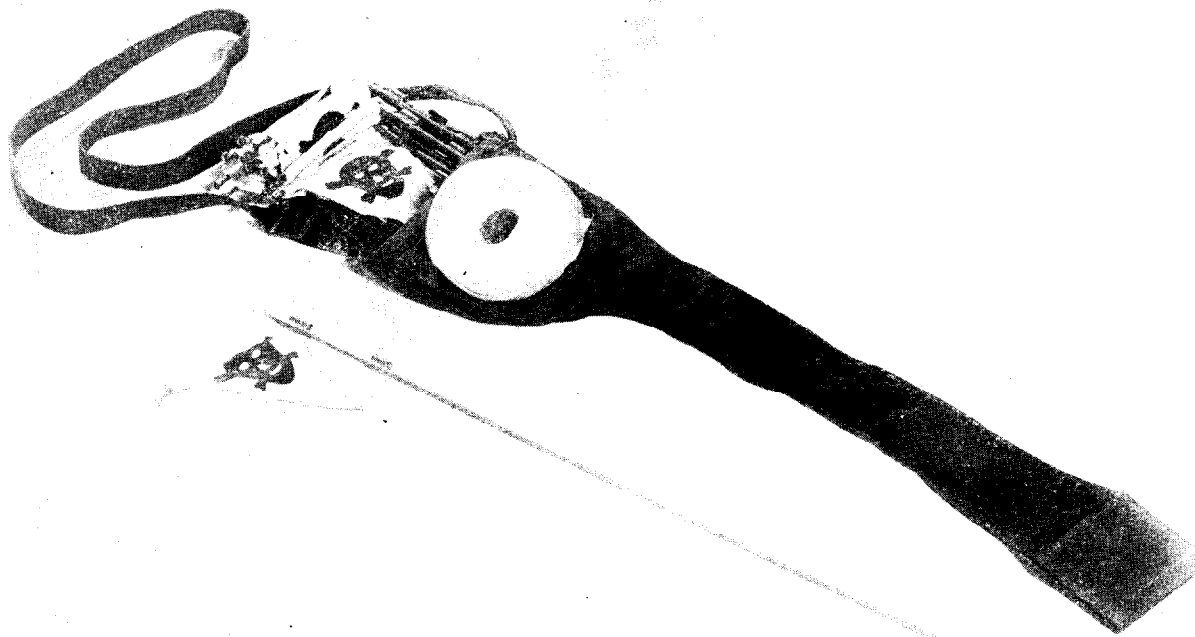


Figure 124.—Gas warning flag set.

(6) *Gas alarm device.* This is a whistling cartridge which is fired from a signal pistol. It rises about 50 feet, giving off either a whitish or green light and emitting a high-pitched whistle audible for about 400 yards.

(7) *Anti-gas pathway material.* This strong paper, impregnated with a tar-like substance, is prepared in rolls, approximately 4 feet wide and 55 yards long. It is stated to be of sufficient strength to allow 200 men to cross a contaminated area in safety.

(8) *Gas warning flag set.* This is a pistol-shaped case containing 20 L-shaped iron rods, 20 warning flags (yellow with black skull and crossed bones imprinted), and a roll of yellow marking tape.

(9) *Collective protector.* This is installed in air raid shelters and other fixed installations. It consists of a pump, either electrically or hand driven, a mechanical canister, a chemical canister, and necessary connections for drawing outside air through the canisters.

(10) *Gas protective case for pigeons.* This is a case of four compartments, each with an inlet tube and filter.

3. War Gases

a. GENERAL. German war gases, generally speaking, have retained their World War I classification. However, "crosses" are believed to have been superseded by the terms "rings" or "bands" for purposes of nomenclature. The appearance of the *FE 42* canister suggests that the Germans are aware of the potentialities of hydrocyanic acid (AC), cyanogen chloride (CK) and arsine (SA). Tests show that this canister affords fair protection against these gases. The Germans are known to favor the combination of gases. Thus, a vesicant toxic smoke is a combination of "blue"- and "yellow"-band gases, and the nature of the chemical filling would be indicated by two bands of the corresponding colors. "Green" and "yellow" bands would indicate a choking gas with vesicant properties. A double "yellow" band would indicate a vesicant gas of enhanced persistence.

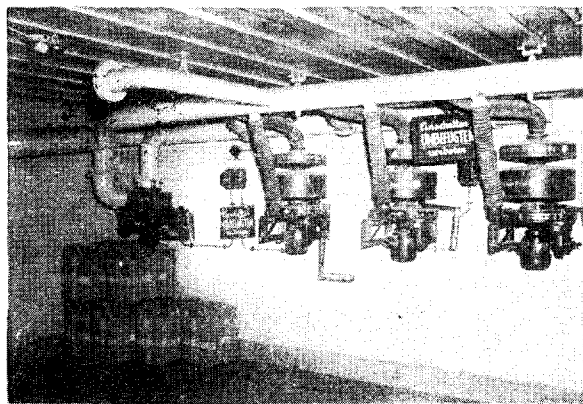


Figure 125.—Set of German collective protectors.

b. NITROGEN MUSTARDS. In addition to the more or less standard agents, there is documentary evidence to show that the Germans possess a nearly odorless gas designated as "Green Band I." It is only one of several gases with like characteristics that may be referred to as "nitrogen mustards."

Generally speaking, the nitrogen mustards are either liquids or low-melting solids, pale yellow to colorless, and are practically odorless. Their volatility varies, some being less volatile than mustard gas and some more volatile. They are fairly readily hydrolyzed by water, but the products of such hydrolysis are toxic.

Nitrogen mustard gas has a low freezing point, and might, therefore, be used for high-altitude bombing or spray (if thickened). It may be three or four times as volatile as mustard gas and therefore less persistent. Since higher concentrations are possible, it is more dangerous as a gas, though not so powerful in its vesicant effect. It would require special stabilization if used in hot climates.

The principal danger from the nitrogen mustards lies in the fact that their vapors are not easily detected by smell. Munitions which contain these gases and have a high bursting charge (20 to 30 per cent HE) are indistinguishable from HE on detonation. Under such conditions, reliance must be placed on the usual U. S. detector methods: that is, detector paint or paper and the vapor detector kit, M-9.

Nitrogen mustard is likely to be used to achieve surprise by being included in a normal HE bombardment in order to capture key positions. It is also possible that this gas would be used as a spray from airplanes, or in aerial bombs.

Common name	German name
<i>Blister gases (Vesicants)—"Yellow Cross"</i>	
Mustard (H).....	<i>Lost; Senf; Gelbkreuz</i>
Lewisite (L).....	<i>Gelbkreuz II (?)</i>
Ethylchlorarsine (ED)...	<i>Dick; Gelbkreuz III</i>
Nitrogen Mustard (HN)...	<i>Stickstofflost</i>

(Mixtures of mustard gas and Lewisite may be used in cold weather to reduce the freezing point. A 50-per cent mixture of mustard and Lewisite is called *Winterlost*. The mustard gas is likely to be an improvement over that of World War I; it is probably more persistent, possibly more vesicant, and more difficult to decontaminate.)

Choking gases (Lung Irritants)—"Green Cross"
Phosgene (CG).....*D-Stoff; Grünkreuz*

Diphosgene (DP).....*K-Stoff; Perstoff;*
Brunkreuz I, II
Chlorpicrin (PS).....*Klop*
Chlorine (Cl).....*Chlor*

(There have been frequent references to mixtures of these choking gases.)

Vomiting gases (Sternutators)—"Blue Cross"
Diphenylchlorarsine (DA)..*Clark I; Blaukreuz*
Diphenylcyanarsine (DC)..*Clark II; Cyan Clark*
Adamsite (DM).....*D. M. Adamsit*
Tear gases (Lacrimators)—"White Cross"
Chloracetophenone (CN).....*T-Stoff*
Brombenzylcyanide (BBC).....*T-Stoff*

(Neither of these gases was used by the Germans in the last war. They relied upon a number of bromine compounds, which are less powerful than the two substances listed. It is thought that Germany attaches little importance to tear gases alone, but the possible use of other gases camouflaged by tear gases must not be overlooked.)

4. Ground Weapons

a. GENERAL. The Germans have a large number of weapons capable of firing chemical warfare munitions—guns, mortars, howitzers, and projectors—with varying calibers and ever-increasing types.

b. GUNS. No less than 12 guns of 75-mm caliber, including a self-propelled model, fire smoke shells. The limitations of gas shells for artillery are clearly recognized by the Germans. Although thus far no German gas shells have been captured, reports indicate that for some time they have been building up extensive stocks of gas-filled shells, 105-mm and 150-mm being the favored calibers. Smoke shells for several types of 105-mm guns, two of which are self-propelled, are known. Smoke shells weighing



Figure 126.—75-mm smoke projectile for tank gun.



Figure 127.—15 cm Nebelwerfer 41 being loaded.

SMOKE PROJECTILES FIRED BY GERMAN WEAPONS

<i>Smoke Shell</i>	<i>Weapon Firing the Munition</i>	<i>Color Markings and Remarks</i>
8 cm Wgr. 34 Nb. 8 cm Wgr. 38 Blau.	8 cm Mortar (S. Gr. W. 34).	Red body. Nb. in white. Blue band. Ejects blue smoke for target indication.
10 cm Wgr. 35 Nb.	10 cm Smoke Mortar (Nb. W. 35).	Brick red or olive green; Nb in white.
*10 cm Wgr. 40 Nb. *10 cm Wgr. 40 Wkb. Nb.	Nb. W. 40. Nb. W. 40.	Brick red or olive green; Nb in white with long burster tube.
20 cm Wgr. 40 Nb.	20 cm Spigot Mortar (le. Ldg. W. 40).	Used by the Engineers. Electrically fired. Range 700 meters.
38 cm Wgr. 40 Nb.	38 cm Spigot Mortar (S. Ldg. W. 40).	Used by the Engineers.

* It should be noted that the HE shell for the 10 cm mortar 40 has stencilled on the tail "10 cm Nb. W. 40", due to the fact that the mortar is the "Nebelwerfer 40", i.e., "smoke" projector.

Figure 128.

approximately 86 pounds are provided for 150-mm self-propelled guns, known as the "Grizzly Bear" and the "Bumble Bee". There are also smoke and incendiary shells for the 150-mm heavy infantry gun.

c. MORTARS. The basic weapon of German chemical warfare troops is the 105-mm mortar, two models of which are known. In addition to the 81-mm mortar, the Germans have a 12-cm mortar that is identical with the Finnish 12-cm mortar made by Tampella. They also have copied the Russian 12-cm mortar. Revolutionary in design are the 20-cm and 38-cm spigot mortars. While these mortars are primarily intended for the destruction of obstacles, minefields, and gun emplacements, smoke shells are provided and there is apparently no reason why gas or incendiary fillings could not be substituted for HE.

d. HOWITZERS. Smoke shells are provided for two types of light field howitzers of 105-mm caliber and three types of 150-mm heavy field howitzers. Projectiles weighing 80 pounds filled with blister and choking gases, for the heavy field howitzers are reported.

e. PROJECTORS. Two general types of rocket projectors have made their appearance during the current war: the *Nebelwerfer* (literally, smoke projector) and the *Schweres Wurfgerät* (heavy throwing apparatus). For details of these weapons see Section VII of Chapter VII.

f. SMOKE GENERATORS. (1) *General*. Smoke generators are often referred to as "thermo-gen-

erators" due to the fact that they produce smoke by the "hot" process, namely, by the combustion of the smoke materials. They may be stationary, thrown by hand or rifle, or by dischargers mounted on tanks. Also, they may be fastened on floats or buoys for amphibious operations.

(2) *Smoke Candle 39 (Nb.K.39)*. This smoke generator consists of a metal can, 5 $\frac{3}{4}$ inches high by 3 $\frac{1}{2}$ inches in diameter, provided with holes in the top for smoke emission. It weighs approximately 4 $\frac{3}{4}$ pounds and is painted green, with two white bands around the body. The Berger-type smoke mixture, consisting of two parts of zinc dust to three parts of hexachlorethane, is fired by a pull type igniter and burns from 4 to 7 minutes.

(3) *Smoke Cylinder (Rauchrohr)*. Designed primarily for use against tanks, this munition consists of a cylinder 10 inches long with a diameter of 1 inch. It contains 7 $\frac{1}{2}$ ounces of a smoke mixture composed of zinc, magnesium, and hexachlorethane. Its total weight is 11 ounces. Ignited by a pull type igniter, it burns 3 to 4 minutes, emitting a dark gray smoke.

(4) *Long-Burning Smoke Generator (Langerkerzer 42, Nb.KL 42)*. This long burning smoke generator is a green, cylindrical metal container with an over-all height of 19 inches and a diameter of 6 $\frac{3}{4}$ inches. It contains approximately 36 pounds of a smoke mixture consisting of zinc, zinc (or ammonium) chloride, and hexachlore-

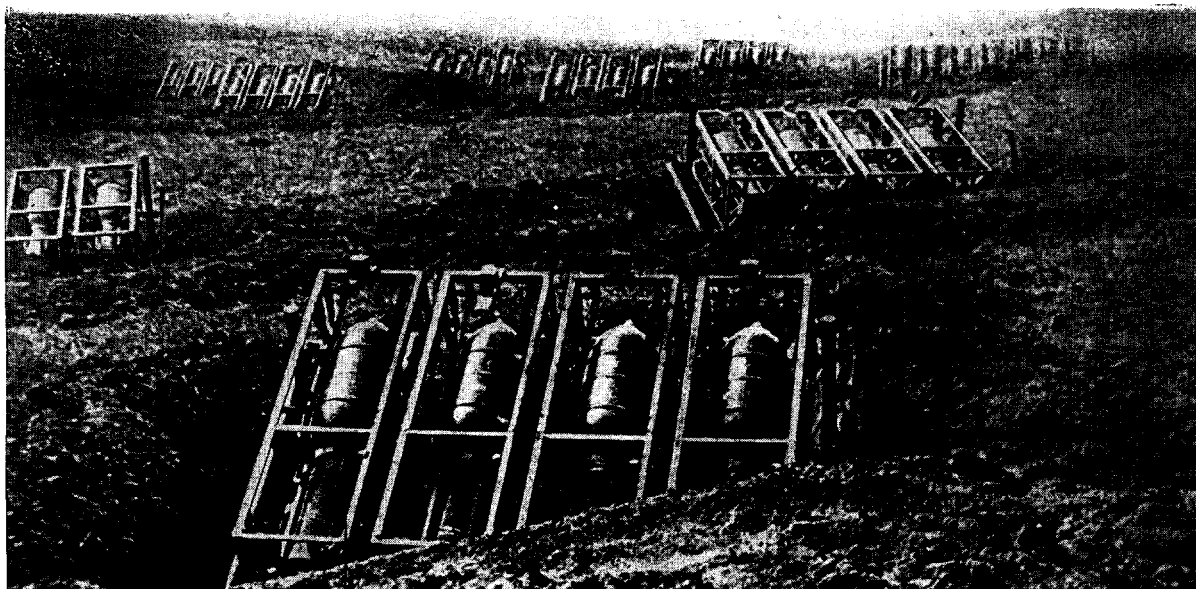


Figure 129.—28/32 cm *Schweres Wurfgerät 41* emplaced for launching incendiary rockets.

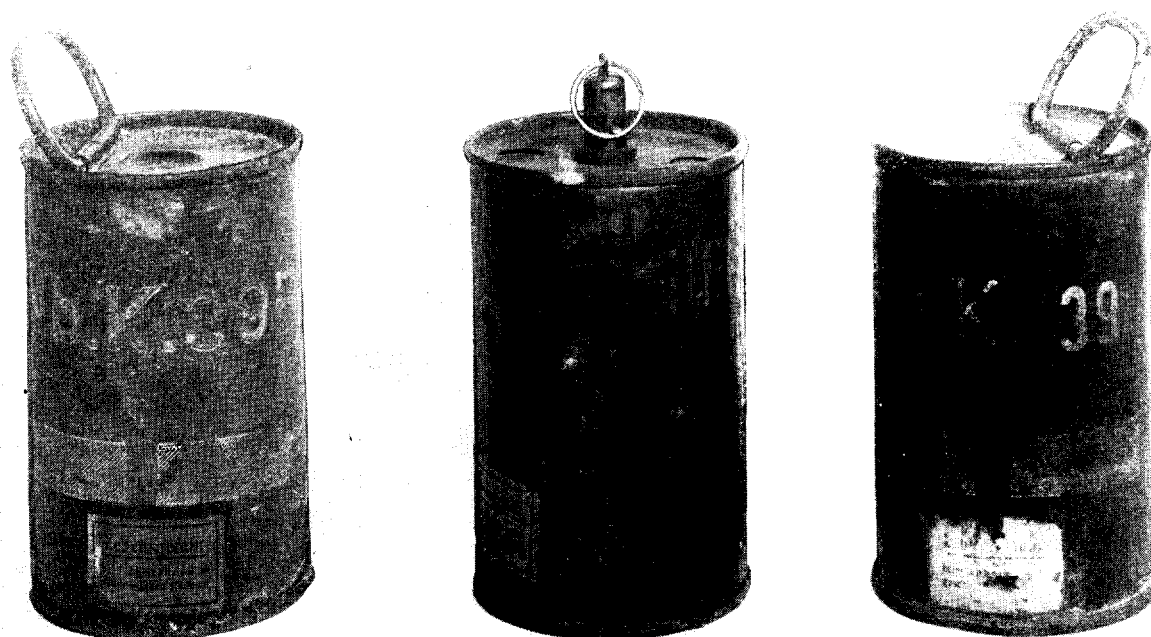


Figure 130.—Smoke candles: Nb.K.39B, Nb.K.S.39B, and Nb.K.39.

thane. Its total weight varies from 35 to 49 pounds. The ignition is electrical or by means of a pull wire. The generator burns 15 to 30 minutes, emitting a whitish gray smoke sufficient to provide a screen 200 yards wide, 400 to 500 yards long and 40 yards deep under favorable conditions.

(5) *French smoke floats.* German E-boats are reported to have used French 132-pound smoke floats consisting of a container, filled with Berger Mixture, a flotation device, a lid, and an igniter. The emission period is 4 to 5 minutes.

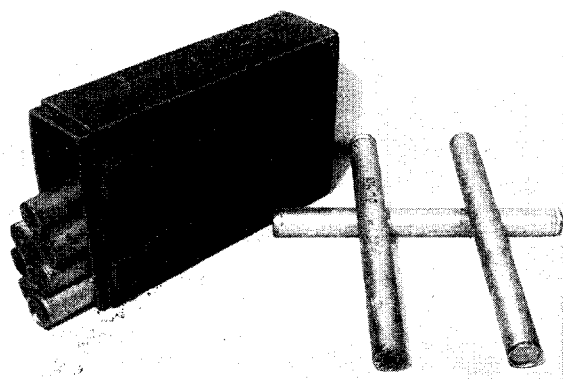


Figure 131.—Smoke cylinders, Rauchröhre Nb. 39.

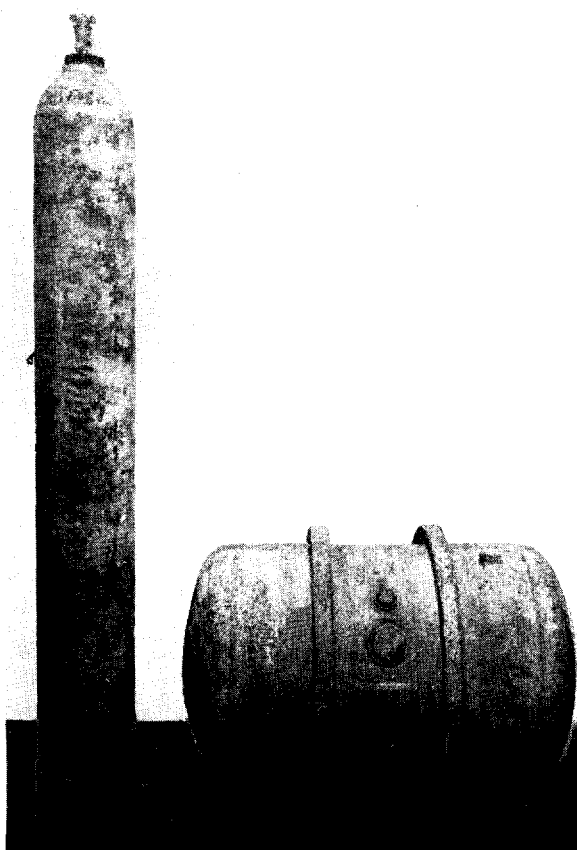


Figure 132.—German smoke apparatus drum and cylinder.

g. SMOKE GENERATOR PROJECTORS FOR ARMORED VEHICLES. The *Pz.Kpfw.III* and *Pz.Kpfw.VI* are provided with smoke generator projectors (dischargers), which are mounted on each side of the turret. They consist of three cylindrical tubes, 6 inches in length by 3.7 inches in diameter, mounted on a bracket one above the other at a fixed elevation of 45 degrees, but slightly splayed to give a lateral spread to the generators. *Nb.K.39* smoke generators are fired from inside the turret. Panther and Tiger Model B tanks are fitted with smoke generator dischargers mounted flush in the right rear top of the turret, at an angle of 60 degrees to the turret roof. They are mounted in a circular ring in such a manner that they may be traversed through 360 degrees. The barrel, $7\frac{1}{2}$ inches long by $3\frac{5}{8}$ inches in diameter, is fitted with a breechblock. The firing mechanism is operated by a trigger from within the tank, projecting the *Nb.K.39* smoke generators.

h. SMOKE SPRAYERS. Smoke sprayers (*Nebelzerstäuber*) disseminate a liquid smoke-producing material by the application of compressed air. The smoke liquid, generally chloresulfonic acid, is atomized or dispersed as minute particles which vaporize and quickly condense again as very fine droplets by absorption of water vapor from the atmosphere. The process is "cold" as distinct from the "hot" process of the smoke generator. The Germans have a variety of smoke sprayers for diverse uses: stationary, portable, mounted on vehicles or tanks, carried on board ship or aircraft, and floating on buoys.

i. GRENADES. *Nebelhandgranate 39* and *41* are smoke hand grenades containing a hexachlorethane mixture. They are of similar design. Both are painted green and are distinguished by the inscription *Nb. Hgr. 39* (or *41*) in white, with a white broken line beneath the lettering. The Germans have two types of glass hand grenades, known as *Blendkörper 1H* and *Blendkörper 2H*, charged with a mixture of titanium tetrachloride (FM) and silicon tetrachloride. They also have incendiary frangible hand grenades of the Molotov-cocktail type, consisting of a pint glass bottle filled with a mixture of benzene and creosote oil. This type is intended primarily for use against tanks.

j. GAS MINES. The German gas mines are referred to as spray canisters (*Sprühbüchse*). They are used by the ground forces for contaminating ground, roadblocks, buildings, or in-

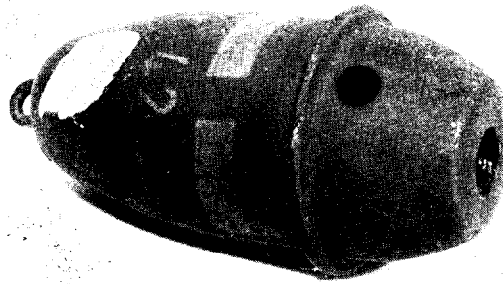


Figure 133.—Egg type smoke grenade.

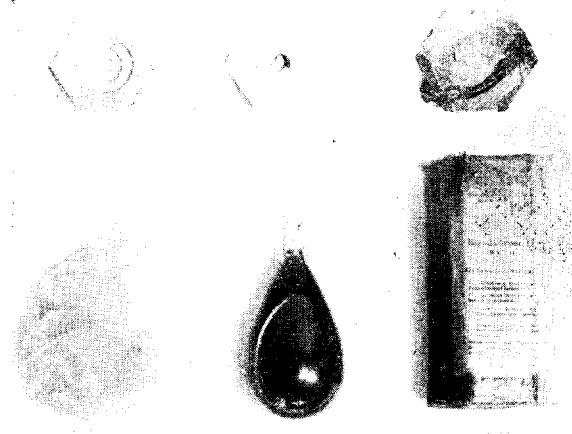


Figure 134.—Frangible smoke grenade, *Blendkörper 1H*.

accessible places. They are also used for harassing landing parties on tidal beaches and for delaying armored vehicles and troops. The mines can be laid at the sides of roads, under bridges, in woods, or in other convenient locations and may be actuated by time mechanism or pressure fuzes. One mine can contaminate an area of 20 to 25 square meters.

k. BULK CONTAMINATION. Any liquid-spraying apparatus (*Sprühgerät*) may be used for bulk contamination. Tanks, armored cars, and trucks may be equipped with apparatus for spraying gas and smoke. Chemical trucks are included in the equipment for the special gas companies. The special spraying apparatus of the decontamination battalions is a potential contaminating apparatus as well, since it may readily be used for offensive purposes, spraying liquid "gases" instead of decontaminating liquids.

l. MOBILE FLAME THROWERS. A flame thrower is a pressure-operated apparatus which projects a jet of liquid ignited as it leaves the gun. Its essential features are: a fuel container, a device

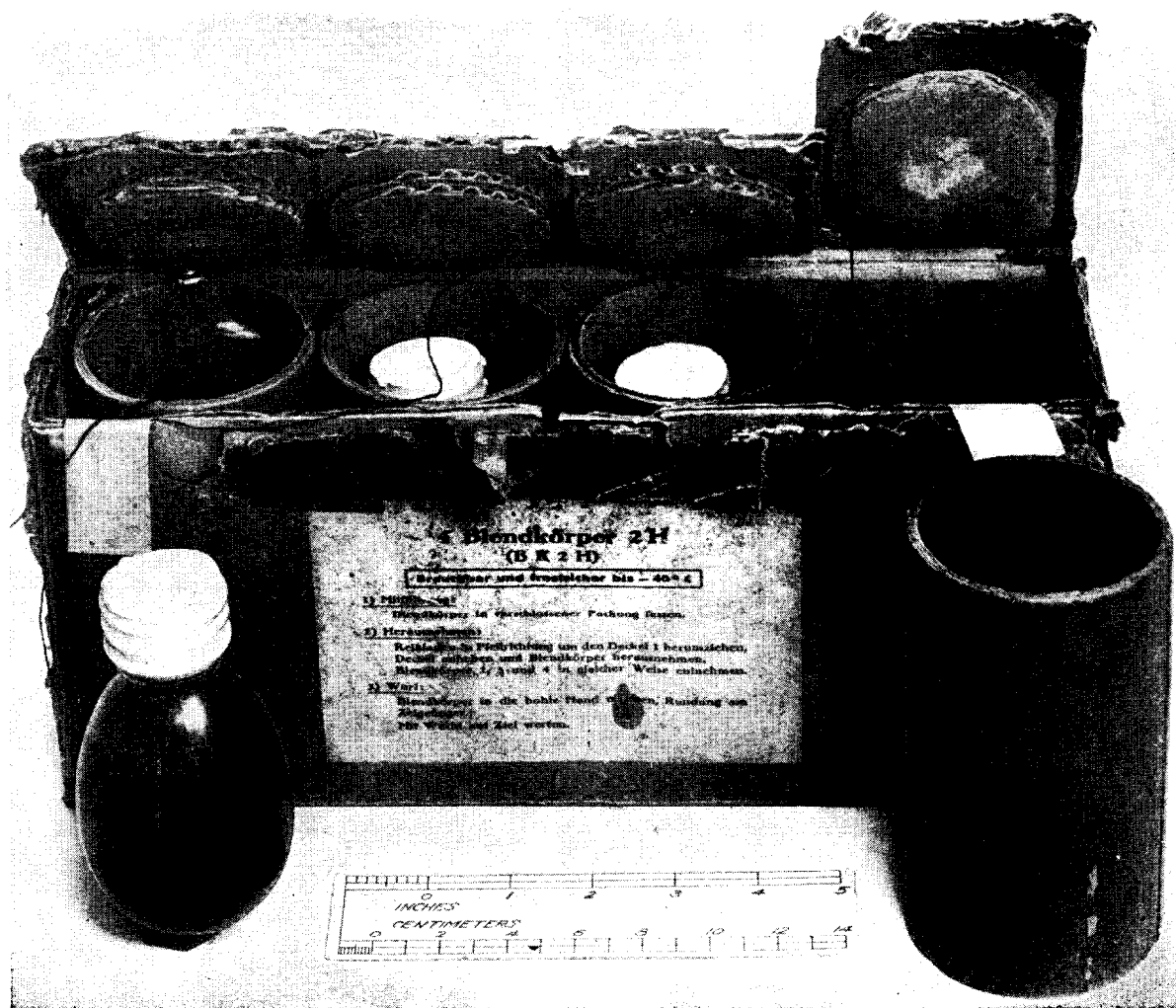


Figure 135.—Frangible smoke grenades, Blendkörper 2H.

for forcing the fuel out of the container, a projecting tube with a nozzle at its end, and an igniting system to set the jet of fuel aflame. The principle types developed by the Germans are as follows:

(1) *Flame thrower, portable, Model 35.* This is the type with which Germany started the present war. It is a modified version of the 1918 model. Both fuel and compressed nitrogen containers are housed in one cylinder. The nitrogen is used for propulsion of the fuel, which is ignited at the nozzle by a jet of hydrogen flame. Both ejection and ignition of the fuel are controlled by the same trigger placed on the top of the gun. It can fire ten one-second bursts as far as 30 yards. Weighing 79 pounds it is too heavy for a single man in action.

(2) *Flame thrower, portable, Model 40.* This is a "lifebuoy-type" flame thrower, weighing

only 47 pounds. However, the decrease in weight has been accomplished by a one-third reduction in fuel, as compared with the Model 35. The range is unaltered.

(3) *Flame thrower, portable, Model 41.* This consists of two cylinders, one for fuel and the other for compressed nitrogen. The complete apparatus weighs 35 to 40 pounds. Ignition is by hydrogen, which flows over an electrically heated wire at the nozzle, where it is lighted and in turn sets the oil afire. Firing is by the "hot" method: the oil is ignited each time the trigger is pulled: thus, the target can not be first sprayed with oil and then set afire. Five blasts can be fired, producing a flame of 700 to 800 degrees centigrade.

(4) *Flame thrower, portable, Model 42.* In appearance it is similar to Model 41, but is slightly shorter and differing in one essential point:

the ignition system. The hot-spot hydrogen jet ignition system of the older model has been replaced by the cartridge system. This consists of a cartridge magazine in which there are ten rimless, blank, 9-mm pistol cartridges, loaded, fired, and ejected in automatic succession at each pull of the trigger. Since the fuel ejection and the firing mechanisms are operated by the same trigger the result is the "hot-firing", wherein prior drenching of the target with oil is impossible. The jet of the fuel is set afire at the instant it leaves the nozzle. The apparatus weighs about 30 pounds empty and up to 40 pounds full. It holds approximately $7\frac{1}{2}$ gallons of fuel, a black oil smelling like creosote. The fuel ejection is by compressed nitrogen gas under a pressure of 441 pounds per square inch. There is no reducing valve on the nitrogen line. The oil is sufficient for 5 to 6 blasts, each lasting 3 seconds, reaching a range of 25 to 35 yards.

(5) *Para-Flame Thrower (Einstoss Flammenwerfer)*. This is another variety of the portable flame thrower. It is the standard one used by the paratroops and also is used to a great extent by the SS. It weighs $23\frac{3}{4}$ pounds. The fuel is the usual black liquid used in other German flame throwers. It is fired from the shoulder, throws a flame 38 yards long, lasting 2 to 3 seconds. It is said to possess a constant, steady pressure producing an even flame. Also, it is claimed that it can be aimed accurately.

(6) *Trailer flame thrower*. This is a flame thrower that bears a resemblance to a "field gun", since it is mounted on a chassis and is towed by a motor vehicle. Fitted on the frame is a box-shaped sheet metal body which contains the fuel tank, the pump, and the engine. The fuel tank is 4 feet $11\frac{1}{2}$ inches by 1 foot $9\frac{1}{2}$ inches, and holds 40 gallons of creosote oil. The pump is a gasoline engine-driven, centrifugal pump. The flame gun is mounted on a spigot on top of the fuel tank to facilitate traversing; the gun itself is carried on trunnions to permit elevating and depressing. It can be traversed 45 degrees each way and elevated between +30 degrees and -10 degrees. The fuel is ignited by an electric spark and the flame will last 24 seconds at a range of 45 to 50 yards, using 1.46 gallons of fuel per second. It has an over-all length of 7 feet 11 inches and weighs 900 pounds. When operating it makes a noise which can be heard easily at a distance of 300 yards.

(7) *Flame thrower on armored car (half-track) (Sd Kfz 251)*. Two flame throwers are mounted on the rear of an ordinary 3-ton half-track armored vehicle, but are controlled from the front seat next to the driver. The flame throwers may be traversed 160 degrees. Length of hose is 11 yards. The tank holds 185 gallons of the usual German flame thrower-fuel. A centrifugal pump propels fuel with a consumption rate of 2 gallons per second. The fuel is sufficient for 80 bursts of 1 to 2 seconds each at a range of 40 to 50 yards. The weapon is fired by an electro-gasoline system.

(8) *Flame thrower on Panzerjäger 38 Chassis. (lc. Pz. Jäg. 38 Chassis)*. The flame thrower is mounted offside on the front of the self-propelled Panzerjäger 38. The fuel capacity is 154 gallons, with a consumption rate of 1.8 gallons per second. Fuel release is controlled by hand through a 14-mm nozzle. The range is 55 to 66 yards.

m. STATIONARY FLAME THROWERS. (1) *General*. These are called *Abwehr Flammenwerfer* by the Germans, a nomenclature that implies the defensive nature of the weapons. They are also known as static flame throwers, emplaced flame throwers, fougasse flame throwers, and flame thrower mines. The latter name is probably due to the fact that they are buried directly behind minefields or are dispersed among the mines to "thicken up" the defense and fired by remote control. Usually they are emplaced behind wire entanglements facing in the direction of probable attack to cover road blocks, landing beaches, harbor walls, and to act as movable obstacles at a gap in defense walls. They are buried at intervals of 12 to 30 yards, well camouflaged, leaving only the horizontal muzzle projecting above the ground. Groups of emplaced flame throwers are controlled from a central point, usually a small pillbox, and are operated either by remote electric control or by trip-wire mechanism.

(2) *Emplaced flame thrower (Abwehrflammenwerfer 42)*. (a) *General*. This apparatus consists of fuel container, flame tube, and propellant container. Necessary accessories are slow burning powder propellant, electric squibs, wire, storage battery, and fuel. It has an over-all height of 2 feet 6 inches.

(b) *Fuel container*. The fuel container is a cylindrical tank 21 inches high and $11\frac{3}{4}$ inches in diameter. It has iron carrying handles, and a capacity of 8 gallons. The fuel is a black viscid liquid smelling like coal tar. It is a mixture of



Figure 136.—German static flamethrower.

pitch and light, medium, and heavy oils. It is a little thicker than the usual flame-thrower oil. The fuel tank holds 7.7 gallons.

(c) *Flame tube.* The flame tube is a 2-inch metal pipe rising vertically and centrally from near the bottom of the fuel container; after passing through the top it curves and extends horizontally a distance of 20 inches. This gives the apparatus a total height of 30 inches.

(d) *Propellant container.* This is a cylinder 10 inches high by 2 $\frac{5}{8}$ inches in diameter. It contains slow-burning powder, an ignition squib, and firing wires. The propellant powder is either black powder or a mixture of nitrocellulose and diethylene glycol dinitrate. The pressure pro-

duced by the explosion of the propelling charge ejects the fuel.

(e) *Performance.* Both electrical squibs fire simultaneously into the pressure chamber. One ignites the propellant powder which generates pressure to force the fuel out through the flame tube; the other ignites the fuel as it passes out of the nozzle. There is an ignition composition of aluminum and barium nitrate at the nozzle. The flame, 5 yards wide and 3 yards high, lasts 1 $\frac{1}{2}$ seconds. The range is 30 yards.

n. FLAME-THROWER TANKS. (1) *General.* These are tanks in which flame throwers are mounted. The flame thrower and its accessories, the fuel tanks, projecting hose, gas cylinders, pump, engines, and ignition system are all so

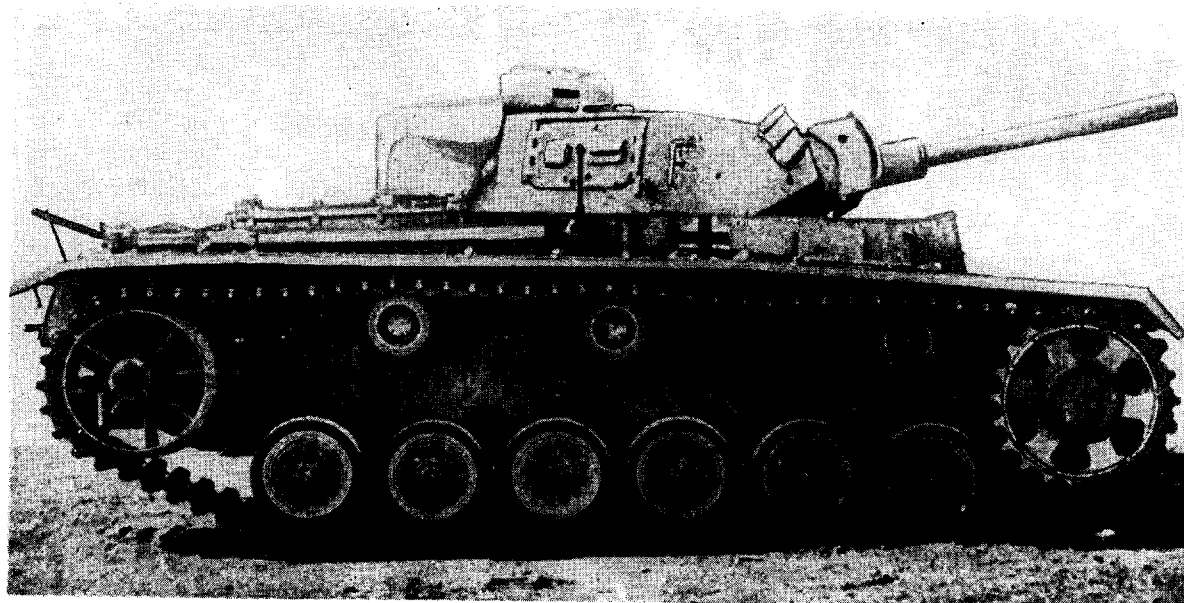


Figure 137.—Pz. Kpfw. III, Model L, flamethrowing tank.

housed in the turret that the vehicles preserve the external appearance of ordinary tanks. They have undergone several modifications and some are obsolescent.

(2) *Flame-Thrower Tank Pz. Kpfw. II (F) (Sd. Kfz. 122)*. This tank has two flame throwing projectors, each mounted in a small turret well forward on the track guards but operated electrically from panels in the turret. The turrets have a traverse of 180 degrees, elevation of 20 degrees, and depression of 10 degrees. Seventy gallons of fuel are kept in two tanks mounted externally on the track guards. The fuel tanks are protected by shields. Fuel is projected by compressed nitrogen. It is sufficient for 80 shots of 2 to 3 seconds duration at a range of 35 yards. Ignition is by acetylene flame.

(3) *Flame-Thrower Tank Pz. Kpfw. III, Model L*. A flame thrower in the turret replaces the normal 50-mm gun (5 cm Kw.K.39), which it resembles outwardly. Traverse is 360 degrees, and elevation is from -10 degrees to +20 degrees. The fuel is a black, sticky oil smelling of creosote and is sufficient for 70 to 80 shots of 2 to 3 seconds duration. The range is 55 to 65 yards. The fuel, 225 gallons, is carried in tanks mounted inside the right and left side.

5. Aerial Weapons

a. **CHEMICAL BOMBS.** (1) *10-Kilogram (22 pounds) Fragmentation Bomb (GC 10)*. This is a toxic smoke and high explosive bomb. It con-

tains an arsenic filling, identified by the Germans with a blue cross.

(2) *50-Kilogram (110 pounds) Mustard Gas Bomb (GC 50)*. This bomb has a highly sensitive impact fuze, with either a small bursting charge for ground contamination or a large bursting charge for antipersonnel effect.

(3) *250-Kilogram (550 pounds) Mustard Gas Bomb (KC 250 GB)*. This bomb has a time fuze which is set to function about 330 feet above the ground. The bomb will contaminate an area of about 6,000 square yards. It is possible that the Germans have gas bombs of larger caliber. A "green cross" (KC 500) bomb has been reported with a choking-gas filling.

b. **SMOKE BOMBS.** (1) *NG 50 Smoke Bomb*. This bomb has a field gray body with white nose. It may have four white vertical stripes or two white bands painted on the body. Its over-all length is 2 feet 7 inches.

(2) *NC 50 H.C.* This bomb is for use on water. It has a field gray or silver body with yellow nose. Four yellow vertical stripes may appear on the body. It is 3 feet 7 inches long and 7¾ inches in diameter. The filling is a Berger Mixture or hexachlorethane.

(3) *NC 250 S.* This bomb is similar to the *Flam. C 250*. It is painted silver with a white band and NC 250 painted between the filling plug and suspension socket. The nose is white, and the tail is olive drab. There are two sizes of this bomb, one weighing 242 pounds and the other

418 pounds. The filling is chloresulfonic acid and sulphurtrioxide.

c. INCENDIARY BOMBS. (1) *1-Kilogram Bomb*. Specimens of this bomb may bear designations *B1 E1*, *B1 E1 Z*, and *B1 E1 ZB*. All types weigh about 2.75 pounds each. The body is painted aluminum or green. The diameter is 2 inches, and over-all length $13\frac{1}{2}$ inches. The filling is 0.44 pounds of thermite.

(2) *2-Kilogram Bomb*. This bomb has the designation *B2 E1 Z* and weighs about $4\frac{1}{2}$ pounds. The body color is aluminum or light green. The filling includes TNT or amatol in addition to thermite. The diameter is 2 inches, and the over-all length is 20.7 inches.

(3) *Oil Incendiary Bomb (Brand C 50 A)*. This bomb weighs 99 pounds. It is painted field gray, with red under the tail, a red band encircling the body, and a yellow stripe on the tail cone. The body diameter is 8 inches, and the over-all length 43.2 inches. The filling is 15 liters (3.3 gallons) of a mixture of 86 per cent benzene, 10 per cent rubber, and 4 per cent phosphorus. It has a bursting charge of picric acid.

(4) *Incendiary Bomb C 50 B*. This is identical in marking, dimensions, and body color with the *C 50 A*. However, it is filled with white phosphorus, and this is indicated by a small red bottle painted on the bomb.

(5) *Flam. C 250*. This bomb weighs 240 pounds. It is painted green with a red nose, two blue tail rings, and two red bands. The diameter of the body is 2 inches, and over-all length is $64\frac{1}{2}$ inches. It contains 16 gallons of oil, weighing 110 pounds, composed of crude oil, aluminum, magnesium powder, and woodmeal-petroleum igniting mixture. The bursting charge is 2.65 pounds of picric acid and TNT.

(6) *Flam. C 250 B* and *Flam. C 250 C*. These bombs are identical with the *Flam. C 250* except markings. The type B and C bombs are painted dark blue or gray and have two red bands encircling the body.

(7) *Brand C 250 A*. This bomb is painted field gray with a red undertail. It measures $14\frac{1}{2}$ inches in diameter and $64\frac{1}{2}$ inches in length. The filling, 15.8 gallons, is a mixture of 87.7 per cent petroleum solvent, 11.7 per cent polystyrene, and 0.5 per cent phosphorus. The bursting charge is picric acid.

(8) *Flam. C. 500 C*. This bomb is painted blue or gray and weighs 440 to 460 pounds.

d. SPRAY TANKS. All German aircraft smoke sprayers, *S 100*, *S 125*, *S 200*, and *S 300*, are similar in construction. They make use of a smoke acid mixture and are operated by gas pressure. The sprayer is a cylindrical apparatus housing an acid container, a small cylinder or bottle of compressed air, air lines with valve, and emission pipe, and nozzle. It is carried externally on the aircraft and can be jettisoned at will. The smoke acid is ejected by compressed air at 45 pounds per square inch. It may be filled to two levels. When charged at low level, it has a weight of 551 pounds; charged at high level it weighs 827 pounds, holding 482 and 758 pounds respectively. The firing is done electrically by operating a magnetic valve. Emission may be interrupted and re-started at will.

Section VII. FIELD RANGES AND COOKING EQUIPMENT

1. General

Various types of field ranges and other cooking equipment are issued to units of the German Army. The most important of these include: rolling field kitchens, field ranges, fireless cookers, and cooking outfit, 15.

2. Rolling Field Kitchens

a. GENERAL. Horse-drawn rolling field kitchens are issued to non-mechanized units. The large rolling field kitchen will serve 125 to 225 men; the small rolling field kitchen, 50 to 125 men. Smaller units do not receive field kitchens but get either fireless cookers or cooking outfits, 15.

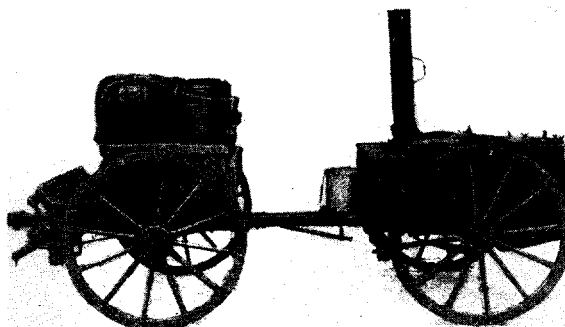


Figure 138.—The rolling field kitchen ready for traveling.

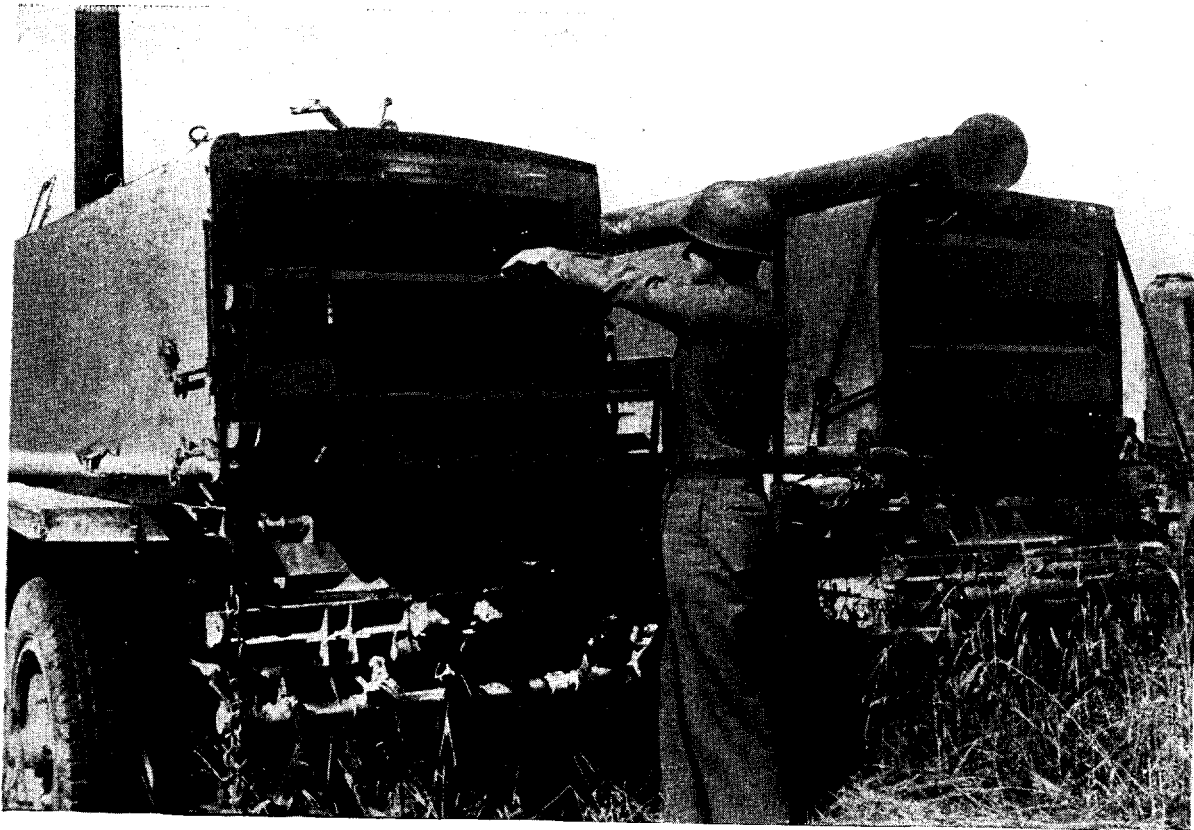


Figure 139.—German field bakery.



Figure 140.—German dough mixer.

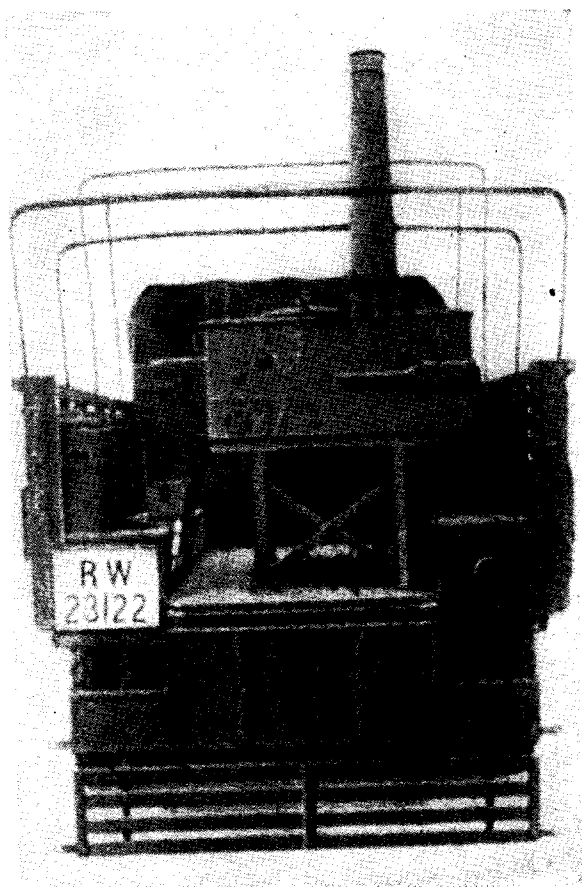


Figure 141.—Small field range mounted in truck.

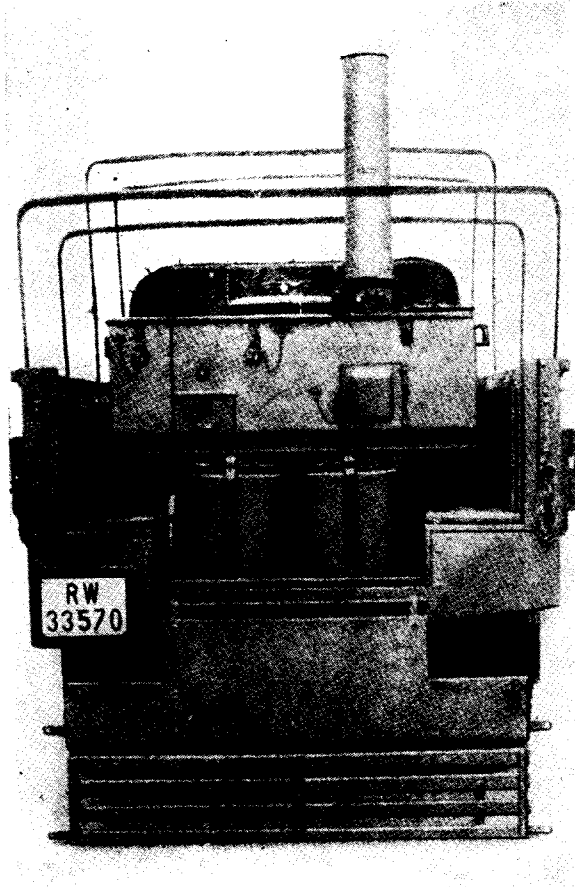


Figure 142.—Large field range mounted in truck.

b. LIMBER AND TRAILER. The rolling field kitchen consists of two parts: the detachable limber and the trailer, on which the field range is mounted. It is drawn either by two or four horses. The limber, on which the driver and cook may ride only during rapid marches, is used to transport most of the supplies, including the extra iron rations which are carried for emergency use only. After the kitchen has been set up, the limber may be used alone to get additional supplies. Under some circumstances the rolling field kitchen without the limber is issued to motorized units, and additional supplies are carried in the light truck used to move the kitchen.

c. COOKING UTENSILS. (1) *Range*. The range itself, mounted on the trailer, can burn either coal, coke, briquettes, or wood. The following is considered the normal issue of fuel:

	Large Field Kitchen	Small Field Kitchen
Briquettes	187 pounds	66 pounds
or Wood	82 pounds	29 pounds
or Briquettes	77 pounds	33 pounds
and Wood	48 pounds	13 pounds

The range normally is used as a fireless cooker, especially when underway. Fires are built in the fire boxes, but as soon as steam starts to escape from the safety valve the fire is banked and allowed to go out. This practice both saves fuel and prevents revealing the unit's position by the smoke.

(2) *Stew kettle*. The main part of the range is a large stew kettle, a kind of double boiler which has a second slightly larger shell around the food kettle. A special liquid between the inner and outer kettles keeps the heat evenly distributed and prevents burning. The double shell cover is provided with a safety valve. The actual capacity of the kettle of the large range is 200 liters (53 gallons), and its cooking capacity is 175 liters (46 gallons). The small range holds 125 liters (33 gallons) and can cook about 110 liters (29 gallons) of soup, stew, boiled meat, or vegetables at one time.

(3) *Coffee kettle*. The coffee kettle has a single shell but a double cover with a safety valve. Ninety liters (24 gallons) of coffee can be pre-

pared at one time in the large range, and 60 liters (16 gallons) in the small one. There is a faucet to draw off the coffee. There is also a broiler in some of the ranges. All have a separate fire box, but use the same chimney.

(4) *Food containers.* After the food has been prepared, it may be transported forward in insulated food containers, six of which are provided with each large rolling field kitchen, four with each small one. These containers hold 12 liters (about 12½ quarts) and weigh about 18 pounds. They consist of an inner and an outer container with air space between them to act as insulation. Special carrying harnesses may be attached to the rings at the four corners of the back.

3. Field Ranges

Field ranges are provided for motorized units. These consist of the same type ranges as used with the rolling field kitchen mounted on a stand in the back of a truck. The supplies which accompany the range are packed in a special chest.

4. Fireless Cookers

Either large or small fireless cookers may be

provided for units of less than 60 men. The large fireless cooker outfit, which weighs 77 pounds, has an insert kettle of 25 liters capacity, while the small one, weighing 53 pounds, has a pot of 15 liters capacity. A cooking fork, butcher's knife, and ladle, as well as a coffee sieve complete the outfit.

5. Cooking Outfit, 15

This 29-pound cooking outfit is issued to groups smaller than those using the fireless cooker. It consists of three nesting pots of 9, 10, and 12 liters (2 to 2½ gallons) capacity, with a ladle, 10 plates, and 10 combination fork-spoons.

6. Bakery Equipment

a. *BAKE OVEN TRAILER.* The German field bake oven consists of a trailer with draw-hearth type ovens, heated by the steam-pipe principle. Seven trailers are issued per bakery company.

b. *DOUGH MIXER.* The German dough mixer, mounted on a single axle trailer, is operated by a gasoline engine. Two are authorized per bakery company.

CHAPTER IX

UNCLASSIFIED

UNIFORMS, INSIGNIA, AND
INDIVIDUAL EQUIPMENT

Section I. ARMY UNIFORMS

I. General

a. PREWAR DEVELOPMENTS. In peacetime the German Army provided its personnel with both a service and a field uniform. The service uniform is an extremely gaudy form of dress. Its purpose was to promote enlistments, and to induce soldiers to vie for the various embellishments awarded for skills, service, and rank. The field uniform was designed to retain these advantages as far as possible, while at the same time providing a practical field uniform. Its designers bore in mind considerations of comfort (fit, warmth in cold weather, coolness in hot weather, body ventilation), utility (adequate pockets, and support for individual equipment, arms, grenades, and ammunition), and security (relative inconspicuousness in different seasons and in different types of terrain). Because of anticipated strategic and production conditions, economic factors had great influence on the field uniform. In particular, the necessity of stockpiling wool and cotton against probable wartime shortages caused the Germans to mix about 30 per cent of rayon with the wool of the uniform cloth. So carefully was this material prepared that the resultant uniforms suffered little actual loss of thermal efficiency and wearing quality.

Armored and mountain troops were provided with special uniforms, while special clothing items were furnished personnel engaged in various other special tasks or on duty in unusual weather conditions. Nevertheless, prior to 1939, there was a remarkable degree of standardization in German Army uniforms, and an equally remarkable emphasis upon retention of traditional features and appurtenances designed to improve individual morale and to cultivate arm and unit *esprit de corps*.

b. WARTIME DEVELOPMENTS. The prolongation of the war into 1942 resulted in a need for

simplification of the field uniform, and in the use of a poorer quality cloth. By the winter of 1943-44, the average wool content of the field uniform cloth had sunk to approximately 50 per cent, with some uniforms dropping as low as 40 per cent. The wool itself was of low quality because it had been re-worked. These recent field uniforms present a shoddy appearance even when new; they also have very poor thermal insulation, and when wet lack strength. The press of economic conditions resulted in the introduction on 25 September 1944 of an entirely new field uniform—the Model 1944. This uniform will replace that designed in 1936 as stocks of the latter are exhausted. The new field uniform is designed to conserve resources and to permit production by relatively unskilled labor.

As the quality of the uniform has decreased, the German High Command has sought to bolster morale by exploiting to the utmost the esteem-building effect inherent in badges, awards, decorations, and arm bands, as well as marks of special units, rank, and specialty. German troops have prized these various symbols so highly that they usually wear them on the field of battle, even though personal security is compromised by nullification of protective coloration, by permitting the singling out of key or expert personnel by enemy observers and snipers, or by facilitating the operations of Allied intelligence. Indeed, such has been the disregard for security on the part of noncommissioned officers and men that they have worn silver instead of dull gray insignia whenever the former has been procurable.

Further recent developments include the provision of additional special uniforms required by the development of specialized troops and the necessity of campaigning under unforeseen conditions of extreme heat and cold. The service uniform has been confined to officers already owning them, officer candidate battalions, higher staffs in the rear, permanent parties of service schools, and similar personnel.

2. Service Uniform

a. GENERAL. Whereas many armies have both dress and service uniforms, in the German Army the service coat (*Waffenrock*) and trousers serve as the basis for the following varieties of dress:

(1) *Gesellschaftanzug*. This is the dress uniform, which in turn is divided into *grossen* (ceremonial) and *kleine* (ordinary) *Gesellschaftanzug*. Long trousers and high black shoes always are worn with this type of uniform. Officers may wear white jackets during appropriate seasons.

(2) *Ausganzug*. This is a type of uniform which might be termed "walking-out dress". In the peacetime Army, it was a most important uniform, since it gave noncommissioned officers and enlisted men an opportunity to display themselves while on pass. It includes service cap, service coat, long piped trousers, high black shoes, and black belt with saber (for senior noncommissioned officers) or decorative bayonet (for junior noncommissioned officers and men). Decorations and awards may be worn, together with a colored tassel on the sword or bayonet. For officers and senior noncommissioned officers, this tassel indicates rank; for others, it indicates by its color the wearer's unit within the regiment.

(3) *Meldeanzug*. This uniform, much like "walking-out dress", is worn on minor occasions.

(4) *Dienstanzug*. This is the service dress proper, worn when attending classes, on duty in an office, or performing other duties not calling for the field uniform.

(5) *Paradeanzug*. This uniform is similar to "walking-out dress", but resembles the field uniform in that steel helmet, boots, and (for enlisted men) cartridge pouches are worn.

b. SERVICE COAT. The service coat (Plate I), which forms the basis for all these uniforms, is highly decorative. The same basic formfitting coat

is used for all ranks. The base color is the warm, field green known to the Germans as "field gray" (*feldgrau*). Collar and cuffs are covered with a dark bluish-green imitation velvet, which also appears as the base for any sleeve insignia that may be worn. The front edge of the eight-button coat opening, the lower edge of the collar, and the upper part of the cuffs are piped in the color of the wearer's arm. Fancy silver patches with buttons are worn on the cuffs. These patches, together with the collar patches, are each mounted on a velvet base dyed in the color of arm. Noncommissioned officers wear silver braid on the upper edge of collar and cuffs, and around the shoulder straps. They therefore present an even gaudier appearance than commissioned officers. Officers and noncommissioned officers of the *Reichswehr* may wear *Reichswehr* coats with proper insignia as service dress (Plate II). These coats also are worn sometimes in the field. Though service coats are of wool, officers may have cotton ones privately tailored for summer wear.

c. SERVICE TROUSERS. The service trousers or breeches made of bluish-gray wool cloth, are piped along the sides in the color of arm. On both sides of this piping General Staff and general officers add a broad stripe in the proper color. Officers may wear service breeches in the field.

d. SERVICE CAP. The service cap is similar to the U. S. Army service cap, but is upswept to give the wearer the appearance of height. The visor is black, with a silvercorded chin strap for officers, and a black leather strap for noncommissioned officers and men. The cap band is of dark, bluish-green imitation velvet (blue-gray for *Sonderführer*), piped top and bottom in the color of arms. Piping also appears around the crown of the cap. The cap cover is field-gray. The national emblem (an eagle, stylized differently for the different Armed Forces and Party organizations), and below it the national colors (black, white, and red) surrounded by oak leaves, are worn on the cap front. Officers often wear service caps in the field.

3. Field Uniform

Since anticipated economic conditions precluded the provision of both service and field uniforms for all German Army personnel, the German Army field uniform was designed to perform the dual purpose of field and service uniform. It therefore retains as many of the morale-raising features of the service uniform as possible. In

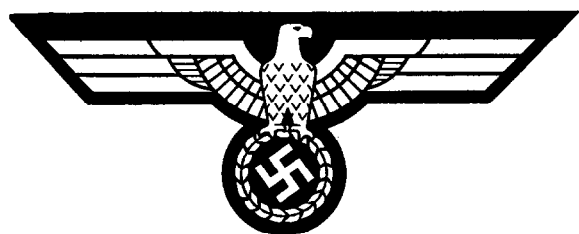


Figure 1.—Army national emblem, worn on the right breast of the field and service coat and on the front of caps. The eagle is silver or gray, on a dark green background. The background is black for the black uniform. Navy personnel wear a similar gold eagle.

wartime, the field uniform is worn in combat and on all occasions except those that call for a fatigue or work uniform. As the war has progressed, the number of embellishments worn on the field uniform has tended to increase, except where economic conditions have interfered. The field uniform includes the following components (some of which have undergone changes during the war as noted):

a. HEADGEAR. (1) *Steel helmet*. The present steel helmet, M1935, is used by all branches of the German Armed forces, although some World War I helmets as well as Czech and Italian helmets still are in use. The M1935 is a smaller and lighter version of the World War I German helmet, from which it can be differentiated by the absence of facepiece lugs which characterized the old helmet. It comes in five basic sizes, which weigh from 1.8 to 2.7 pounds. Two ventilation holes are furnished at the sides. The suspension consists of an adjustable, leather-padded, spring-aluminum band, secured at the sides and rear of the helmet by three cotter keys. The chin strap is leather. Prior to the war, the national colors were worn on the right side of the helmet and the national emblem on the left side. These emblems are no longer worn.

(2) *Old-style field cap*. The old-style field cap (Plate I) is of field-gray wool-rayon cloth. It is cut similarly to the U. S. WAC garrison (over-sea) cap, except that the turn-up is scalloped downward in front. This scallop is provided so that the eyes are left uncovered when the turn-up is lowered to protect the neck and ears. The front of the cap is decorated with the national emblem and the national colors. An inverted "V" in the color of arm at one time enclosed the national colors. Officers wear silver braid around the top of the crown and along the edge of the scallop (Plate II). The cap is designed to be worn under the steel helmet.

(3) *M1942 field cap*. The M1942 cap is an early type of field cap, tried out in 1936, and re-issued in 1942 as a new type. It resembles the old-style field cap, except that the turn-up is buttoned in front (Plate III). The turn-up flaps may be buttoned across the chin.

(4) *M1943 field cap (Einheitsmütze)*. In 1943 a visored wool-rayon cap was introduced (Plate III) for all types of troops. Like the mountain cap and M1942 field cap, the turn-up may be used to protect the ears and back of the neck, with the buttoned flaps securing across the chin. The turn-



Figure 2.—Field Cap M1942. The mountain cap and the Field Cap M1943 may be worn with the turn-down buttoned across the chin. The toque is shown worn under the cap.



Figure 3.—Believed to be the M1944 Field Uniform coat. The material incorporates a large amount of rayon.



Figure 4.—Latest type of field uniform trousers with built-in cloth belt, known as *Rundbundhosen*. The belt buckle shown is that of the *Waffen-SS*.

up feature is unhandy and ineffective, even if the winter wool toque is worn underneath the cap. National emblem and colors are worn as on the other types of cap.

(5) *Toque*. A wool-rayon knit toque is issued to protect the head and neck in cold weather. It may be worn under the cap or helmet (Figure 2). This toque is not a balaclava helmet, but consists of an unshaped sleeve with neck and face openings.

b. BODY CLOTHING. (1) *Coat*. The coat (*Feldbluse*) has appeared in several models.

(a) *Prewar coat*. The prewar coat was designed to be as handsome as possible, while at the same time providing a comfortable, practical, field coat affording maximum security and utility. Four pleated patch pockets are provided, with an inner pocket along the lower part of the right front flap for the first-aid kit. The gray-painted, stamped metal buttons are quickly removable, and are standard for all Armed Force uniforms. The sleeve ends are split so that they may be buttoned fairly snugly around the wrist. The collar is built like the collar of a U. S. shirt, except that it is stiff and is worn without a tie. Until 1943 the coat collar was protected by a sweat band (*Kragenbinde*) which buttoned to the inside of the collar. The coat collar was designed to be worn closed, although the collar hooks and top coat button might be freed in the field. Support for personal equipment is furnished by two adjustable metal belt holders in both front and rear. These coats were furnished with dark, bluish-green, imitation velvet collars and shoulder straps. Similar material was used as a backing for the national emblem worn on the right breast (often mistaken for an aviator's wings), and for chevrons and specialty badges.

Officers' prewar field coats are similar to those for noncommissioned officers and men, except that cuffs are worn. Officers, however, may wear the issue coat with proper insignia. General officers wear gold buttons and a gold national emblem. Chaplains' coats always have been distinguished by lack of shoulder straps. Since officers purchase their uniforms privately, some officers have acquired cotton field uniforms of field-gray color for summer wear.

(b) *Wartime changes*. As mentioned above, material shortages and production difficulties resulted in a lowering of the quality of the coat material. Besides the shoddy appearance of the newer coat, the most noticeable differences are the



Figure 5.—Field gray uniform for crews of self-propelled guns. These units now wear death's head collar patches.

absence since mid-1943 of pocket pleats, and the use of straight-edge instead of pointed pocket flaps. The color of the cloth also tends towards a gray rather than a warm green. (Compare in Plate I the private in field uniform, who wears the prewar coat, with the first sergeant in mountain uniform, who wears the later type of coat.) Necessity finally has compelled adoption of the Model 1944 coat (see Figure 3), the main apparent differences of which are tailoring modifications permitting the use of less skilled labor and the conservation of materials.

(2) *Trousers.* (a) *Prewar trousers.* Until 1943, full trousers of the same field-gray material as the field uniform coat were issued to the German Army. Suspenders are used with this type of trousers which have two sets of suspender buttons sewn in place. Many of these trousers have reinforcements in the seat. Many have semi-breeches legs, so that the leg ends easily may be fitted into the marching boot. Two slanting buttoned front pockets, a buttoned hip pocket, and a watch pocket with ring are provided. The trousers may be tightened at the waist by means of two tapes and a metal buckle in the rear.

(b) *Belted trousers (Rundbundhosen).* In

1943 the German Army was issued field uniform trousers with built-in cloth belt after the style of *Afrika Korps* clothing. The decision to drop suspender trousers was governed by two considerations: the impracticability of suspenders when only shirt and trousers are worn, and the inconvenient and, under combat conditions, dangerous necessity of removing the coat and battle equipment to let down the trousers. These trousers are still cut high. Like ski or mountain trousers, the legs are tapered to fit into leggings or shoe-tops.

(3) *Overcoat.* The double-breasted six-button, wool-rayon overcoat is standard for all ranks, except that general officers wear gold buttons and have red lapel facings (and administrative officials in general-officer grades wear dark green facings). Collars, once of dark, bluish-green imitation velvet, now tend to be plain field-gray wool. The coat, which is cut narrow at the waist, flares at the bottom, and has two side slash pockets. The ordinary leather belt may be worn, run through slits on the side so that it runs inside the rear of the overcoat without interfering with the cloth belt at the back. Overcoats have degenerated in quality of material in the same manner as the field coats.



Figure 6.—Cotton- or linen-twill fatigue and work uniform in the cut of the field uniform coat.

(4) *Sweater.* A light-weight wool-rayon, V-neck sweater always has been furnished as part of the field uniform. It is worn under the coat. A green band around the neck distinguishes Army sweaters; Air Force sweaters have a gray-blue band.

(5) *Gloves.* A pair of field-gray knit wool-rayon gloves is furnished in the winter with the field uniform.

(6) *Underwear.* (a) *Prewar type.* The type of Army underwear issued until 1943 consists of a long-sleeved undershirt and long underdrawers, worn in all seasons. They are made of medium-weight, tricot (machine-knit) cotton cloth, which gradually has incorporated increasing amounts of rayon. Since the war began, an increasing proportion of Army underwear has been dyed green for camouflage.

(b) *1943 shirt.* In 1943 the collarless undershirt was replaced by a green tricot combination shirt-undershirt with collar and two buttoned breast pockets. The shirt remains a pullover type. The collar obviates the need for a sweatband inside the coat collar. When worn with the coat collar closed, the shirt shows slightly above the edge of the coat collar. When the coat is worn with the collar hooks and top button open, the shirt collar is worn outside the coat collar (see the 1st sergeant in mountain uniform, Plate I). The provision of a fairly presentable shirt-undershirt makes possible a coatless summer uniform.

c. *FOOTGEAR.* (1) *Footwraps and socks.* The German soldier is furnished with long, wool-rayon socks and with footwraps. The latter are of the best quality wool or of cotton flannel, cut in large squares. One square is wrapped around each foot over the socks before the shoe or boot is put on. Boots are fitted to two pair of socks, or one pair of socks and one pair of footwraps.

(2) *Jack boots (Marschstiefel).* Short boots have been the traditional footgear of German soldiers for centuries. This type of footgear, however, both requires an inordinate amount of leather and causes unnecessary wear on the heel during the march. The traditional marching jack boot therefore has received much adverse criticism in the German military press. By 1941 its use was limited to infantry, engineers, and motorcyclists. Issue finally has been completely suspended, although existing stocks will be used up.

(3) *Anklet leggings.* Short leggings worn with high shoes now replace the jack boot. The leggings are of cotton or linen duck, with the

lower edge rimmed with leather. Each legging is secured on the outside with two leather straps with metal buckles.

(4) *High shoes (Schnürschuh)*. High laced leather service shoes have always been part of the field uniform issued by the German Army. They now replace the boot entirely, instead of serving as alternate footgear.

d. **FATIGUE OR WORK CLOTHING.** Prior to the war and during its first 2 years, individuals might be issued both a work suit and a fatigue suit with the field uniform. Generally only one was issued each man, the work suit being reserved for those with heavy tasks, such as motor maintenance. Both are cut in the same style, but the work suit is of unbleached linen woven as herringbone twill, while the fatigue suit is of a lighter linen herringbone twill dyed a rush green (Plate III). In 1943 a fatigue coat, cut in the style of the field uniform coat, was issued. This latter type, often of a cloth containing a high percentage of rayon, may serve as a summer uniform.

e. **ISSUE.** The field uniform as described above is issued to all troops except those requiring special uniforms or special clothing issue because of unusual tasks or because they are expected to operate under abnormal terrain or weather conditions.

4. Special Uniforms and Clothing

Special clothing issued to German Army troops varies from minor changes or additions to the field uniforms, to uniforms of completely different cut, color, and material.

a. **BLACK UNIFORM.** Prior to the war, a black uniform was furnished crews of German Army tanks and armored cars. This uniform, which has undergone slight changes, now is worn by crews of "Elephants", by tank-destroyer and assault-gun crews in *Panzer* and *Panzer Grenadier* divisions, and by tank and armored-car crews.

(1) *Headgear.* (a) *Beret.* Until the winter of 1939-40, troops wearing the black uniform wore a black beret, which served as a crash helmet. This helmet type of headgear proved unnecessary.

(b) *Black field cap.* During the winter of 1939-40, a black, wool-rayon field cap, in the style of the old-style Army field cap, replaced the black beret.

(c) *1934 black field cap (Einheitsmütze).* Simultaneously with the introduction of the field-gray *Einheitsmütze* for the normal field uniform, the black uniform received a similar visored cap

in black cloth. Insignia and braid for officers follow the field-gray cap pattern.

(2) *Body clothing.* (a) *Coat.* The black, double-breasted, wool-rayon coat issued with the black uniform is known as the "field jacket" (*Feldjacke*). It is illustrated in Plate II. Recent jackets lack the piping on the edge of the collar, and some may have large pockets on the left breast. The coat is made of the same quality of wool-rayon cloth as the field uniform. It is dyed black to conceal dirt and grease stains. A metal death's head is worn on each collar patch.

(b) *Trousers.* The black, wool-rayon trousers of the black uniform are referred to as "Field trousers" (*Feldhosen*). They resemble the later type of normal field uniform trousers in cut, with ski-pant legs. They are fitted with tapes, however, so that they may be bound to the leg at the ankle.

(c) *Underwear.* Underwear consists of long drawers and a collared tricot shirt-undershirt with black necktie. Until 1944, this shirt was gray. Issue since that date has been green, and therefore identical with underwear for the normal field uniform.

(d) *Two-piece coverall.* For camouflage purposes, for a summer uniform, and for a work garment a two-piece coverall of rush-green cotton or rayon is issued. It is cut identically with the black wool uniform.

(3) *Footgear.* Standard black service shoes, long socks, and footwraps are worn. The use of boots with the black uniform is contrary to German regulations.

b. **FIELD-GRAY UNIFORM FOR ARMORED-VEHICLE CREWS.** A wool-rayon field-gray uniform, identical in cut with the black uniform, was issued in the spring of 1940 to crews of assault guns. This uniform is worn by the crews of the assault guns and tank destroyers of infantry, light infantry, and mountain infantry divisions. The uniforms bear a death's head on each collar patch. Crews of armored trains and of self-propelled infantry and antiaircraft guns wear the same uniform with the usual field uniform collar patches (Plate II). A two-piece, rush-green coverall, identical with that issued to troops wearing the black uniform, also is issued to those wearing the field-gray uniform for armored-vehicle crews.

c. **MOUNTAIN UNIFORM.** The mountain uniform is similar to the normal field uniform with the following exceptions:



Figure 7.—White cap cover for the mountain cap.

(1) *Cap.* The visored mountain cap, derived from the visored Austrian cap of the last war, is the original model for the M1943 *Einheitsmütze*. The mountain cap may be distinguished by a metal *Edelweiss* sewn to the left side of the cap (Plate I). A white camouflage cap cover is furnished with the cap.

(2) *Coat and overcoat.* Field uniform coats and overcoats are worn, but are embellished by an *Edelweiss* on the upper right sleeve (Plate I).

(3) *Windjacket.* The mountain windjacket is a light, double-breasted, long jacket of olive-colored, windproof, water-repellent duck (Plate III). This is less common now than the parka, which appears to be superseding it.

(4) *Sweater.* The mountain sweater, heavier than the normal field uniform sweater, has a turtle neck for added warmth.

(5) *Trousers.* Baggy trousers, designed and fitted so as not to bind the mountaineer at any point, are provided German mountain troops. These trousers are of the usual field-gray, wool-rayon cloth. Their ski-pant bottoms tie with tapes at the ankles. Special mountain suspenders are issued with these trousers.

(6) *Parka and overpants.* Until 1942, a white parka was issued on the basis of 10 per cent of unit strength. By the time of the Caucasus campaign, a new and improved type of parka, with overpants of the same material, was furnished to mountain divisions. The parka is reversible, with a tan and a white side, and is distinguished by three buttoned breast pockets. The cloth is unusual, in that the rayon fibers are designed so that some provide strength, while

others swell when wet. The swelling action renders the garment water-repellent to a high degree. When dry, the fiber shrinks, permitting proper ventilation through the garment. The objective of the designers was to avoid the accumulation of sweat, which, if the wearer should rest after heavy exertion, would cause undue dampness and cooling and result in colds, pneumonia, and frostbite.

(7) *Canvas overmittens.* These mittens with leather palms are furnished in addition to the field uniform wool gloves to provide extra insulation against cold and to keep the wool gloves dry.

(8) *Ski-mountain boots.* Heavily-hobnailed, high laced shoes are provided as ski-mountain boots.

(9) *Leggings.* Until October 1944, short, wrap leggings of field-gray wool, such as those used by Austrian mountain troops in World War I, were standard for German mountaineers. Now these are being replaced by the canvas leggings issued with the normal field uniform.

(10) *Rock-climbing shoes.* High climbing shoes with rope or felt soles are issued when necessary.

(11) *Camouflage clothing.* Prior to 1941, white parkas or white suits were issued to mountain troops for operations in snow-covered regions. The present mountain parka and windproof trousers have a tan and a white side.

d. **SPECIAL CLOTHING FOR MOTORCYCLISTS.** Motorcyclists receive as supplementary clothing a raincoat; a pair of goggles; a pair of gauntlets; and, in winter, an extra sweater, wool oversocks, and a special coat. The gauntlets are of overcoat cloth with trigger finger, and may have leather palms. The footless oversocks come up high on the leg. The raincoat is a special, long, rubber coat, designed to be buttoned in a variety of ways to improve protection and to facilitate operation of the motorcycle (see motor vehicle coat in the color plates). This rubber coat also may be worn by drivers of light vehicles. In winter, a surcoat may be furnished—a heavy wool garment cut like the overcoat, but sufficiently large to be worn over all clothing including the overcoat. Recent surcoats have wool hoods.

e. **SPECIAL CLOTHING FOR DRIVERS.** Drivers of all types of vehicles receive motorcyclists' gauntlets, and for cold weather the surcoat. Drivers of horse transport also receive felt overboots with wooden soles.

f. SUMMER UNIFORM. Prior to 1941, no uniform for field summer wear was issued. Since that date, uniforms developed for the *Afrika Korps* have been made available to troops operating in arid and tropical climates, such as prevail in Italy, Greece, the Crimea, and the Kuban delta. Mention already has been made of the adaptation of the normal field uniform and normal fatigues as a summer uniform. The summer field uniform proper includes the following items:

(1) *Headgear.* The first *Afrika Korps* troops were provided with tropical helmets and khaki cotton field caps in the cut of the old-style field uniform cap. These soon were replaced by a visored khaki cotton field cap copied from the mountain cap.

(2) *Body clothing.* Body clothing consists of loose-mesh rayon or cotton undershorts and short-sleeved undershirt; a two-pocket, grayish-green or khaki cotton shirt carrying shoulder-strap insignia; and khaki shorts or long trousers with built-in cloth belts. Though shirtsleeves may be the uniform of the day, a roll-collar, V-necked, khaki coat is furnished. In spite of cotton shortages, the coat and trousers continue to be of good quality cotton twill. Since late 1942, however, the four pleated pockets of the coat have been modified in the same fashion as those of the normal field uniform coat. The cotton twill breeches furnished in the very early days of the *Afrika Korps* are worn only by those still possessing them.

(3) *Footgear.* Desert boots with cloth tops are no longer necessary, but still may be encountered. High brown leather shoes are now the standard wear. Wool socks, rather than footwraps, are worn.

g. WINTER UNIFORMS. (1) *Pre-1941 winter clothing.* Prior to the winter of 1941-42, the German Army made little provision for winter warfare. Mountain troops were the best equipped to fight under conditions of extreme cold and snow; the remainder of the Army received special clothing only for special missions and duties, as noted above. Sentries were the only soldiers, besides drivers and motorcyclists, who received specially designed clothing. To them were issued surcoats and felt overboots, or, if the latter were lacking, straw overboots. Ordinary troops wore the wool toque, gloves, sweater, and overcoat in winter.

(2) *Post-1941 winter clothing.* As soon as the necessity for great quantities of winter cloth-

ing became obvious, the German Army attempted numerous improvisations based on many varieties of civilian, military, and captured clothing. Even



Figure 8.—Improvised winter clothing. The ordinary overcoat has been wrapped around the legs and the lower part of the coat bound with strips of cloth secured by cords.

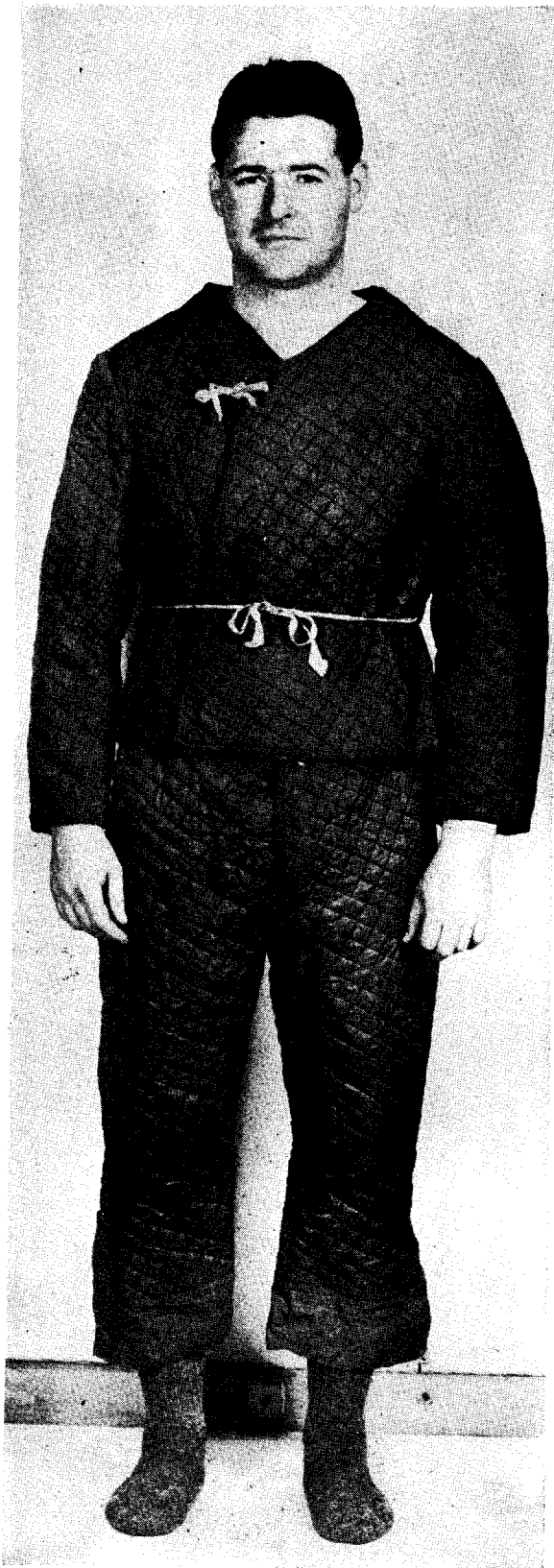


Figure 9.—Padded coat and trousers worn under the new winter uniform.



Figure 10.—The toque. Two toques are shown, one colored white to show the manner of wearing two in extreme cold.

though a standard winter uniform was developed in 1942 and issued for the winter of 1942-43, stocks have been inadequate. The necessity of providing heavy winter clothing for other than combat troops has required continued improvisations. These include rabbit-fur jackets and vests, as well as sleeveless and sleeved pile jackets of rayon known as "breastwarmers". Soviet pile caps and felt boots often are used. For sentries and others who are compelled to remain fairly motionless in the cold, overcoats and surcoats with extra linings are available. Heavy sheepskin surcoats, originated by the German Air Force, also may be used. However, a most important development is the new winter uniform.

(3) *New winter uniform.* The new winter uniform is designed to provide a comfortable combat uniform giving freedom of movement and use of equipment, yet offering protection against extreme cold and overheating during periods of exertion. The uniform is worn over the normal field uniform. Cartridge pouches are worn on the normal leather belt, under the skirt of the parka. This feature aids in providing essential body ventilation to prevent the accumulation of sweat. Several clips of ammunition are kept available in the parka pocket. The hooded parka has a waist belt, bottom drawstring, and double-buttoned flaps up the front that provide a windproof



Figure 11.—Improvised camouflage coat in the cut of the Army field uniform coat. The cloth is taken from shelter duck material of an Italian shelter half.

closure. A toque is worn under the steel helmet, and when the wind is strong, a stiff, felt face mask may be fitted. The trousers have two side pockets, and fairly short legs. These legs fit over special, white, rayon-canvas boots which have fabric soles and three-layer walls. The latter may be stuffed with straw or paper as added protection against cold and moisture. Since these boots are not suited for mud conditions, ski-mountain boots or felt boots with leather soles and facings may be used instead. The parka, toque, and trousers are issued in three weights. The most common is the medium weight, in which the material consists of two layers of windproof cloth with a rayon-wool in-



Figure 12.—New winter uniform with mottled side out.



Figure 13.—Flak personnel in summer uniform.

terliner. The windproof cloth has the same water-repellent features as the latest mountain parka. Since the complete uniform contains only 9 per cent wool, the clothing is heavy for its warmth, and therefore not as efficient as the Germans had planned. The uniform originally had a white and a field-gray side, but by 1943 the need for better camouflage had become so apparent that a mottled design was substituted for the field-gray. Two designs of mottle are used—one is that of the normal shelter half, and the other is that of the Army camouflage jacket (Plate III). Both types are in use. To facilitate

recognition, cloth bands in the color of the day may be buttoned to the sleeves of the parka.

h. CAMOUFLAGE CLOTHING. The original pre-war issue of a camouflage shelter half proved insufficient for the camouflage of individuals. After considerable improvisation on the part of field units, particularly in Italy, a standard Army light-rayon camouflage jacket (Plate III) was issued and put into use in 1943-44. Various types of field-made jackets, using German and Italian shelter halves, are widely employed. Snipers may wear complete camouflage suits, including face masks. Headgear camouflage often

is improvised, since the Army did not provide a standard camouflage helmet cover until the issue of the camouflage jacket. But a very practical elastic band to fasten camouflage materials to the helmet was furnished to all troops. Camouflage clothing is usually organizational, and is issued to snipers, personnel of outposts, and like troops.

Section II. GERMAN ARMY INSIGNIA

I. General

German Army insignia are intended to establish clear differentiation between ranks and types of service, and at the same time to encourage individual combat efficiency and proficiency in military arts. Direct appeal is made to vanity and to the human tendency to show off military prowess as expressed in terms of insignia and decorations. Many of these insignia are based on traditional German military insignia selected from units famous in German popular and military history.

2. Insignia of Rank

Insignia of rank mainly are determined by shoulder-strap devices (Plate IV and V). While there are many minor complexities having to do with fine differentiation among various ranks, services, and functions, these do not concern the average case. A clear distinction is made among commissioned officers (*Offiziere*), noncommissioned officers (*Unteroffiziere*), and enlisted men of various grades (*Maanschaften*). Because of the importance of noncommissioned officers in combat and on the drill field, they are accorded special distinguishing marks beyond the normal insignia of rank. Along the lower edge of their coat collar they have a silver or gray braid .4 inch wide. First sergeants, as senior company or battery noncommissioned officers, wear two bands of similar braid on each coatsleeve. Distinction is made between the upper three and the lower two grades of noncommissioned officers. The former are known as *Portepceunteroffiziere*; the latter as *Unteroffiziere ohne Portepce*. The former are entitled to special considerations and privileges, as are the first three grades of U. S. Army noncommissioned officers. These include wearing on certain occasions an officer's saber

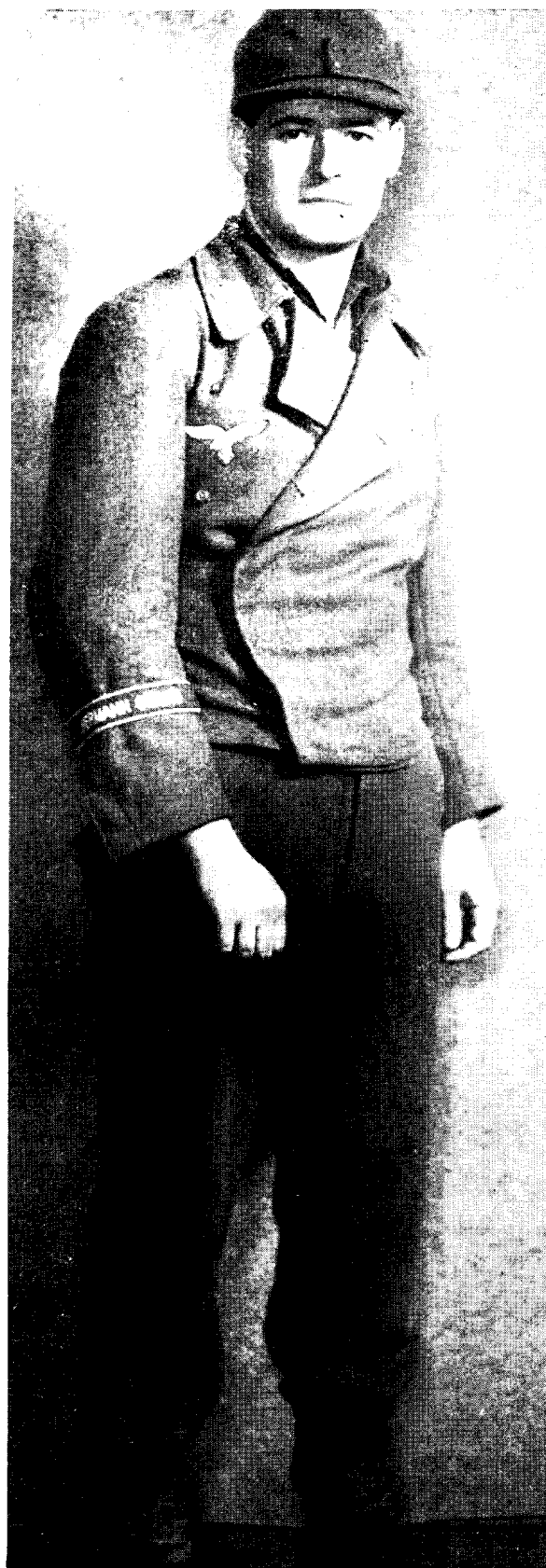


Figure 14.—Tank destroyer uniform of the Hermann Goering Division (shoulder insignia of rank is missing on the uniform shown).

and a tassel known as the *Portepee*, hence the title. Fatigue clothing carries the type of non-commissioned-officer insignia used on *Reichswehr* uniforms.

3. Insignia of Arm and Specialty

In order to clarify an individual's duties, to afford easy recognition of line troops, and to avoid jealousy arising from rapid promotion of qualified specialists, the German Army has made a somewhat ill-organized effort to distinguish line personnel of the arms; personnel of special and administrative services, and personnel of both preceding categories who are so proficient or qualified that rapid promotion to suitable rank is necessary. The first group wear insignia of the line arms (normal insignia of rank and of arm); the specialists and administrative officials tend to be designated by varied insignia (usually by introducing a basic dark-green color); the third group (*Sonderführer*) wear modifications of normal insignia. *Sonderführer* insignia for line duty is shown in color plates; insignia for *Sonderführer* of the Corps of Administrative Officials is somewhat similar as regards the collar patch, but the shoulder strap is more difficult to differentiate. In peacetime and during the early part of the war, further differentiation was made to indicate reserve officers, *Landwehr* officers, officers recalled to active duty, and officers over the retirement age who might be required from time to time for consultation.

4. Fourrageres

All German officers are entitled to wear the fourragere shown on the officer's service dress in Plate II. Adjutants wear a single cord. The adjutant's fourragere must not be mistaken for one of the 12 grades of marksmanship awards (Plate VII), and 1st sergeant in service dress (Plate I). The marksmanship awards sometimes are worn in combat.

5. Use of Numbers and Letters on Shoulder Insignia of Rank

Although the wearing of numbers and letters furnishing unit identification is forbidden in forward areas, German soldiers do not always observe this regulation. Soldiers of the Field Army, however, usually wear such identification in the form of slip-over cloth strips, with the numbers running across the shoulder strap with the length of the strip. In rear areas, numbers

are worn as shown in Plates IV and V. Arabic numerals indicate the number of the regiment or battalion to which the wearer belongs. Enlisted men and the lower two grades of noncommissioned officers wear numbers in the color of their arm; other noncommissioned officers wear silver numbers, as do officer candidates. Officers wear gold numbers. Letters may be combined with Arabic numerals. In some cases (See Plate VI), these indicate units of special arms or of special branches of arms. In other cases, the letter D and an arabic numeral indicate division headquarters personnel. Since regulations have changed frequently since 1939, the system of identification by numbers and letters is difficult to follow without the aid of complex guides.

Section III. GERMAN AIR FORCE UNIFORMS AND INSIGNIA

I. General

Although many items of uniforms and clothing of special Air Force design are provided, many items are procured from the Army in suitable colors. There is not, however, the degree of standardization in Army and Air Force clothing that would appear desirable, particularly in view of the number of Air Force ground troops performing the same functions as comparable Army troops. This is especially true in regard to the uniforms provided for Africa, and now used as summer field uniforms. Characteristic of most Air Force uniforms is the gray-blue color of much of the uniforms and equipment. Comments made on the decline of cloth quality in Army uniforms are equally applicable to Air Force uniforms.



Figure 15.—Air Force national emblem, worn on the right breast of coats, overcoats, jackets, jump suits, and summer shirts.

2. Uniforms

a. **SERVICE AND DRESS UNIFORMS.** The German Air Force no longer has service uniforms, except for a white summer coat and a dress mess jacket for officers, and a service coat for generals. A service coat for all personnel was already in the process of being replaced in 1939. This coat (*Tuchrock*) resembles the present uniform coat (*Waffenrock*), except that it is not designed to be buttoned up to the neck. (Compare the private's and the colonel's coats on Plate VIII.)

b. **NORMAL FIELD UNIFORM.** (1) *Headgear.* The Air Force field cap (*Fliegermütze*) is a simple wool-rayon cap similar in cut to the present U. S. WAC garrison cap. The national colors are worn below the national emblem. Officers wear silver braid around the edge of the turn-up. The Army *Einheitsmütze*, in Air Force color and with proper insignia, has begun to replace the *Fliegermütze*. The Army M1935 steel helmet, painted gray, is issued when required.

(2) *Body clothing.* (a) *Coat.* The standard Air Force coat (*Waffenrock*) is a five-button coat, designed to be worn either with the collar closed at the neck, or as a roll-collared, V-neck coat with the collar hook and top button open (Plate VIII). Four pleated patch pockets are furnished, with the national emblem appearing over the right breast pocket. Two adjustable metal belt holders of Army style are located toward the sides of the uniform. The sleeves end in large cuffs. The collar at one time carried piping on the lower edge in the color of the arm. Though this feature was discontinued in 1940, such coats still may be found. Insignia of rank are worn on the shoulder and on patches located on the ends of the collar. In 1944 this coat was issued in cotton-rayon instead of wool.

(b) *"Flight blouse" (Fliegerbluse).* Air Force troops more commonly wear a short, cuffless, fly-front, wool-rayon jacket with slash pockets (Plate VIII). The jacket's collar may be worn open or closed. Belt holders, insignia, and piping (if the latter is worn) are placed as on the coat. The jacket is intended for crews of aircraft, and therefore is designed so that there will be no buttons, patch pockets, or cuffs to catch on projecting parts of aircraft interiors. The jacket is sufficiently convenient and smart-looking, however, to be popular with all Air Force troops.

(c) *Trousers.* The gray-blue, wool-rayon, Air Force trousers are similar in cut at the waist

to Army suspender trousers. Air Force trousers, however, are always slacks, and are not fitted with narrow or ski-pant bottoms except in the case of mountain trousers.

(d) *Shirt.* Gray shirts of mottled gray-blue thread are worn with black tie. The shirts may be fitted with shoulder straps to indicate rank.

(e) *Underwear.* Army underwear is worn.

(f) *Sweater.* The Air Force sweater is identical with the Army's, except that the colored band at the neck is Air Force gray-blue.

(g) *Overcoat.* A blue-gray version of the Army overcoat is worn. Patches are placed on the collar. First sergeants wear their sleeve bands (Plate VIII).

(3) *Footgear.* The Air Force uses Army-type jack boots, shoes, socks, and footwraps. Leggings, when used, are Army leggings dyed blue-gray.

c. **MOUNTAIN UNIFORM.** Normal Air Force uniforms are combined with Army issue, properly colored when necessary, to make up mountain clothing (Plate VIII). The *Waffenrock* and mountain trousers are used, together with blue-gray, ankle-wrap leggings and ski-mountain boots. The Air Force mountain cap, which had but one button securing the turn-up in front, largely has been replaced by a cap in the style of the Army mountain cap. Army *Edelweiss* badges may be worn.

d. **FATIGUE AND WORK SUITS.** Flak crews and aircraft mechanics may be furnished with a cotton-linen-rayon, herringbone twill, black or dark blue-gray coverall with fly front (Plate IX). Two-piece work suits of various colors are also used (Plate X).

e. **SUMMER UNIFORMS.** Air Force issue resembles that of the Army both in history and in the nature of the items provided, except for slight modifications in all pieces of clothing. Peculiar to the Air Force are bright aluminum, built-in trouser belt buckles, and the long, baggy trousers with ankle buckles illustrated in Plate IX. As in the case of the Army, the tropical helmet no longer is worn except by those who still retain the original issue. The Air Force national emblem appears on all coats and shirts.

f. **PARACHUTE TROOPS UNIFORMS.** Parachute troops are issued several distinctive items. They are:

(1) *Helmet.* The parachute helmet, resembling a cut-down version of the M1935 steel helmet, is fitted with large sponge-rubber pads and leather suspension shaped to the skull.

(2) *Jump suit.* The older types of jump suit—used in 1939-40—were of the pullover, coverall variety. The present types button up the front like coats, and have snap closures to secure the bottom tightly around the legs—a feature borrowed from the older types. Ample zipper-closed pockets are provided. The material is a light shelter duck, originally olive in color (Plate IX), but in present versions always mottled. The present jump suit, like older types, is worn over the wool or summer uniform, but can quickly be removed.

(3) *Camouflage jacket.* Usually peculiar to parachute troops (and worn by the 1st Parachute Division during the Battle of Cassino—hence the appellation “Green Devils”) is a greenish, mottled camouflage jacket about the length of the jump suit. This is a fly-front, cotton, herringbone twill garment with two pockets (Plate IX).

(4) *Footgear.* Several types of jump boots have been issued. The earlier types laced along the sides and had heavy corrugated-rubber soles. Later types resemble the U. S. parachutist's boot. In battle, Army-type high service shoes may be worn.

g. **WINTER CLOTHING.** The Air Force uses the Army winter uniform, and improvises in the same way as the elder service. Often worn by *Flak* sentries in very exposed positions is the very heavy sheepskin surcoat shown in color plates. This coat may be worn by the entire gun crew, if necessary. It is, however, too heavy for infantry combat use.

h. **UNIFORMS OF THE *Fallschirmjäger-Panzer Division Herman Goering*.** This division follows unusual practices in the issue of uniforms and insignia. The collar patch is white for all ranks, while the color of the shoulder strap varies according to type of service. Tank crews and crews of self-propelled guns wear Army black or field-gray jackets and field trousers, but with Air Force insignia.

3. Insignia

Air Force insignia are extremely complex. There are four systems of indicating rank: that used on the shoulder straps and on sleeve chevrons; that used on the collar patch; that used on flying suits; and that used on both sleeves of the motor vehicle coat and on fatigue coveralls. The collar patches of noncommissioned officers' overcoats, and their coat collars, are edged with

silver braid in the manner of Army noncommissioned officers' coats. The awards for combat flights (see color plates) easily may be mistaken for pilots' insignia because of their shape. The pilot's insignia, however, is worn as a metal or cloth badge on the lower left breast, whereas the awards for combat flights are worn above the left breast pocket. Not illustrated under awards in the color plates is that for night fighters, which consists of the award for fighters with a black instead of a silver winged arrow. Air Force personnel are awarded marksmanship badges of a design similar to that of Army awards. Other fourragères are worn, indicating commissioned rank, adjutant, or merely length of service.



Figure 16.—National emblem of the Armed Party Elite Guard (*Waffen-SS*). This emblem is worn on the left sleeves of coats, overcoats, and jackets, and appears either on the front or on the left side of caps.

Section IV. ARMED ELITE GUARD UNIFORMS AND INSIGNIA.

1. Uniforms

The Armed Elite Guard (*Waffen-SS*) has followed the Army closely in the provision of uniform clothing. When first sent into the field, *Waffen-SS* units were distinguished in part by the type of roll-collar V-neck coat shown in Plate XVIII. Also distinctive were their camouflage jacket (Plate XVIII), and their brown shirts with black ties. For some time stocks of the *SS* coat have been practically exhausted, and Army coats have been used. Army shirts also are issued. There remain slight differences between the high grade shelter-duck, water-repellent, windproof *SS* camouflage jacket and the similar Army jacket; the *SS* jacket has two slant, buttoned pockets at its side in later versions, and a different camouflage pattern.

A new *Waffen-SS* uniform is a linen-cotton, herringbone twill, two-piece suit (Plate XIX).

SS regulations forbid wearing insignia on the collar of this uniform, but troops have shown an increasing tendency to include all possible insignia devices. However, no insignia are worn on the one-piece tank coverall (Plate XVIII). In general, *Waffen-SS* uniform clothing differs from that of the Army only in respect to the above items, and in the more complete authorized issue to *Waffen-SS* troops. Moreover, when complete issue cannot be made, the *Waffen-SS* troops always receive fuller issue than their Army neighbors. *Waffen-SS* troops now also receive the army winter uniform, which replaces the special SS pullover parka illustrated in Plate XIX.

2. Insignia

Waffen-SS troops wear shoulder insignia of rank similar to those of the Army, but wear collar patches of the *General-SS*. The sleeve insignia of rank, worn on camouflage jackets, coveralls, and similar clothing, is the same as that worn by corresponding Army grades. The grades of snipers' badges, shown in color plates, are issued to *Waffen-SS* as well as to Army personnel. Rifle regiments of *SS-Police* divisions wear collar patches similar to those worn by officers and men of the Army. The distinctive insignia of the *Waffen-SS* is the *SS* national emblem worn on the upper left sleeve. Noncommissioned officers wear silver braid along the edge of the collar in the manner of Army noncommissioned officers.

3. Uniforms and Insignia of the Security Service of the *Waffen-SS*

This uniform consists of the ordinary *SS* field uniform with Police shoulder straps to indicate rank, *SS* collar patches, and an *SD* badge (for *Sicherheitsdienst*) on the lower left sleeve.



Figure 17.—*Waffen-SS* camouflage jacket with buttoned pockets.



Figure 18.—Uniform of the Security Service (*Sicherheitsdienst*) of the *Waffen-SS*.

Section V. GERMAN DECORATIONS

German decorations for valor consist of the various grades of Iron Cross shown on Plate XXII, together with the Honor Roll Clasp. In actuality, iron crosses of the first and second classes may be allotted in bulk to combat units, whether or not the personnel are individually deserving of such decorations. At one time there appeared to be some plan on the part of German authorities to keep locations of the various types of decorations, combat service, and ordinary service, and ordinary service awards distinct and recognizable as such even to the relatively uninitiated. In brief, this plan seemed to be to locate campaign and ordinary service awards above the left breast pocket in the form of ribbons, with participation in notable campaigns indicated by badges on the sleeve. Combat and wounds would be indicated by badges of bronze, silver, and gold located on the left breast, while actual decorations



Figure 19.—German Air Force officers wearing decorations and awards.

would be worn as ribbons in the buttonhole, at the neck, or in the form of the easily recognizable actual metal medal pinned on the uniform. This rule holds as a rough guide, but there are many exceptions, notable among which are the various foreign ribbons for valor worn with other ribbons above the left breast pocket. Marksmanship awards are worn in the form of fourrageres across the right breast.

The German Armed Forces place much emphasis on the morale effect of the various decora-

tions and awards, the numbers of which are almost incredibly large because of the authorization of the wearing of Nazi Party and Police badges, as well as foreign decorations and those of minor German states under the German Empire. Much of the paper-work of the German Army is concerned with the awarding of various types of medals and badges and their certificates. The German troops themselves prize these honors highly, and wear them on the field uniform even in combat.

Section VI. AUXILIARY FORCES AND SEMI-MILITARY ORGANIZATIONS

I. General

There are a host of puppet and auxiliary forces and semi-military organizations which may take part in combat alongside the Army, Navy, and Air Force. Included among these are the various units raised from former citizens of the Soviet Union. While many of these troops were intended to have insignia peculiar to their organization, it has not been possible in practice to manufacture and issue the necessary uniforms and insignia. The insignia for these forces may be grouped into three sets: those for the Eastern Legions (*Ostlegionen*), those for the Russian and Ukrainian Armies of Liberation (with rank insignia after the Russian style), and those for Cossack units. In practice, German Army uniforms and insignia often are used. Military organizations with uniforms and insignia also were formed from men recruited from the former Baltic states. A Czech puppet Army, with its own uniforms and insignia, also exists. The Italian Republican Army also may use German uniforms and *Waffen-SS* insignia, although Italian Republican insignia may be worn on German-made uniforms. Women's uniformed auxiliary forces include signal services for the Army, Navy, and Air Force; antiaircraft personnel for the Air Force; and remount units for the Army. Such personnel have uniforms, insignia, and titles of rank peculiar to their organizations. Many uniformed Party organizations of a semi-military nature exist, as well as Frontier (Customs) Guards, Railway Police, State Railway Personnel, the Forestry Service, and other uniformed state organizations. Uniforms and insignia of several of the more important auxiliary organizations serving with the armed forces are briefly described below. These organizations usually wear an arm band inscribed *Deutsche Wehrmacht* when in forward areas. The Germans state that such arm bands indicate that the wearers are members of the German Armed Forces.



Figure 20.—Labor Service private (left), sergeant (center), and general officer (right).



Figure 21.—Uniform of an enlisted man of the German State Police.

2. *Volkssturm* Uniforms and Insignia

The German *Volkssturm* has no authorized uniform or insignia except for an armband variously stenciled *Deutscher Wehrmacht* or *Deutscher Volkssturm* with *Wehrmacht* directly underneath the upper two words. These bands may be in a variety of colors: black letters on red or white cloth, or white letters on yellow cloth. Clothing is issued according to what is available in the area. *Volkssturm* personnel are reported to be unwilling to fight if furnished only with armbands for fear of being arrested as *franc tireurs*. Efforts have therefore been made to provide Army issue when possible. This issue is supplemented by captured clothing: Italian, Czech, French, and so on. Uniforms of Nazi party organizations may also be worn. It is reported that personnel with civil and party uniforms such as street car crews, zoo keepers, postmen, *SA* men, etc. will have such uniforms dyed military field gray. The only known insignia of rank is the following:

German Rank	English Equivalent	Collar Patch Insignia
Volkssturmmann	Private	No pips
Gruppenführer	Squad Leader	One pip
Zugführer	Platoon Leader	Two pips horizontally
Waffenmeister	Ordnance Officer	Same as above
Zahlmeister	Paymaster	Same as above
Kompanieführer	Company Commander	Three pips diagonally
Ordonnanzoffizier	Administrative Officer	Same as above
Adjutant	Adjutant	Same as above
Bataillonführer	Battalion Commander	Four pips in square

3. Labor Service Uniforms and Insignia

Members of the Labor Service (*Reichsarbeitsdienst*, or *RAD*), wear uniforms with chocolate-brown collars. The coats generally are cut in the style of the Army field uniform coat. The rank insignia resemble and roughly follow those of the Army, although distinctive titles are employed. A stylized spade is used for the cap badge, and appears on the belt buckle.

4. Police Uniforms and Insignia

German State Police uniforms may readily be differentiated from Army uniforms by proper identification of the Police coat. This coat has four



Figure 22.—Company commander of the *Volkssturm*. The overcoat is the standard Army issue, worn with the field cap M1943. The man at right wears an Italian Army overcoat.

patch pockets, the lower two being pleatless (Fig. 21). The frontal closure is secured by eight buttons. Both collar and cuffs are brown in color, the latter each bearing two buttons. While the collar insignia for lower ranks resemble those of the Army, the collar patch rectangle is surrounded by a silver cord. However, police officers of general's rank wear *SS* collar patches (color plates), since they hold ranks in both *SS* and Police. Field and company grade police officers wear shoulder straps and collar patches similar to equivalent Army ranks, and are addressed by Army titles of rank. A national emblem similar to the sleeve insignia for Army Military police (color plates) is worn on the upper left sleeve, but no other national emblem is worn on the coat. This emblem is repeated on Police caps. The back of the police coat has a decorative double fly embellished with four buttons.

Section VII. INDIVIDUAL EQUIPMENT

I. Field Equipment

a. **BELT.** The German soldier habitually wears his belt, with or without field equipment. Normally the enlisted man wears a black leather belt, but a web belt goes with the tropical uniform. The belt always is worn with a steel buckle bearing the branch of service emblem. All ground forces of the Army (*Heer*) have a buckle embossed with a circular crest in the center of which appears an eagle. The circle is formed by the words "Gott mit uns" above the eagle and a wreath below. The Air Force (*Luftwaffe*) buckle carries an eagle in flight with a swastika in its claws. The figure is encircled by a wreath. The Armed Elite Guard (*Waffen SS*) buckle bears

an eagle whose outstretched wings extend across the top of the buckle. The words "Meine Ehre heisst Treue" make a nearly complete circle below the eagle's wings. The bird rests on another smaller circle which bears a swastika. Officers wear brown leather belts with a simple tongue-and-bar type buckle. In the field the soldier carries his cartridge pouches, bayonet, entrenching tool, and "bread bag" suspended from this belt. When not wearing field equipment he wears the belt and buckle alone. Metal hooks in the field blouse help hold the belt in place.

b. **CARTRIDGE POUCHES.** The usual German cartridge pouch is made of leather. It has three separate pockets, each holding 10 rounds of rifle ammunition in two clips. The uniform belt slips through loops on the back of the ammunition



Figure 23.—Field equipment of the German infantry soldier (front view). The cartridge pouches on the belt are partially held by leather suspenders. The "bread bag" and canteen with cup are carried on the right hip, and the entrenching tool and bayonet are carried on the left hip. The "bread bag" is hung on the belt, and for demonstration purposes is shown further forward than usual.



Figure 24.—Field equipment (rear view). Messkit, shelter quarter, and a small bag (concealed under the shelter quarter) are strapped to the combat pack. The canteen hangs from the "bread bag." (Mounted troops carry the canteen on the bread bag's right-hand fittings). The upper end of the metal gas mask carrier is suspended by a sling over the shoulder, while the rear end is hung on the belt.

pouch, which also has a ring into which the cartridge belt suspenders may be hooked to help support the equipment worn on the belt. Normally two pouches are worn, one on each side of the belt buckle, allowing the rifleman to carry 60 rounds of ammunition. However, soldiers who are not expected to use a great deal of ammunition receive only one pouch, and a leather loop with a ring is substituted for the second pouch to hold the cartridge belt suspenders. Other types of cartridge carriers include submachine-gun ammunition pouches, engineer assault pack pouches, and bandoleers. The submachine-gun pouches, now usually made of webbing, hold six clips. They are about 9 inches long and are carried in a manner similar to the ordinary pouch. The 120-round bandoliers, usually of camouflage pattern, are worn by paratroops slung across the chest. They are held in place by loops slipped over the belt. Medical soldiers receive single-pocket, leather, first-aid pouches which are somewhat deeper and about two-thirds as wide as the ordinary cartridge pouch.

c. ENTRENCHING SHOVEL. Although some of the old-style German entrenching shovels, which are like the old U. S. army shovel, still exist, most German troops are equipped with the standard folding shovel, similar to the standard U. S. entrenching tool. The German shovel consists of a 6 by 8½-inch pointed steel blade hinged to an 18-inch wooden handle. The hinge is provided with a threaded plastic nut which locks the blade in any one of three positions: in line with the handle for use as a shovel, at right angles to the handle for use as a pick, or folded back against the handle for carrying. A leather case for carrying the shovel is suspended from the cartridge belt on the left hip. Since the shovel serves as an adequate pick, few entrenching pick-mattocks are used.

d. BAYONET FROG. The bayonet hangs from the cartridge belt in a leather frog just ahead of the folding entrenching shovel or directly over the old-style entrenching shovel. A loop on the shovel case holds the scabbard in place.

e. BREAD BAG. The German soldier carries the bread bag (*Brotbeutel*) on his right hip, suspended from the belt. This duck bag holds toilet articles, the field cap when not worn, a towel, and other necessities of the combat soldier. Dis-mounted personnel carry the canteen snapped into the left hook on the flap of the bread bag. It is held securely in place by slipping the strap which



Figure 25.—Parachutists bandolier, holding 120 rounds of ammunition in rifle clips.

runs around the canteen through the loop on the lower part of the bread-bag flap. Mounted personnel carry the canteen on the right side of the bread bag. Formerly a special strap was used more frequently to allow the bread bag to be slung over the shoulder.

f. CANTEEN. The canteen, which holds nearly one quart, has a felt cover. The canteen cup, either round or oval, is strapped upside down over the mouth of the canteen. The first of these German canteens were made of aluminum, but about 1942 a few were made of a plastic impregnated wood and recent ones have been made of enameled steel. Mountain troops receive a slightly larger canteen. Special medical canteens are issued to medical troops.

g. GAS MASK. The only other item which commonly is suspended in part from the belt is the gas mask in its metal carrier. The top of the carrier is held by a strap which runs around the right shoulder. The bottom is hooked to the back of the belt. Paratroops receive a special fabric

gas-mask carrier to reduce the danger of injuries in landing.

2. Combat Equipment

a. **CARTRIDGE-BELT SUSPENDERS.** There are a number of different types of leather cartridge-belt suspenders issued to German troops and webbing counterparts for use with the tropical uniform. The commonest of these are the infantry suspenders. These are issued to combat troops of infantry divisions who also receive the combat pack and the Model 39 haversack. The infantry suspenders consist of straps with hooks on the front to attach to the cartridge pouches and a single broad hook in back, which is slipped under the cartridge belt. D-rings on the back of the shoulder straps may be used to hold the top of the combat pack, the haversack, or other equipment. The bottom of these suspenders are held by auxiliary straps riveted to the suspenders in front just below the shoulders. Other common types include officers' cartridge-belt suspenders and cavalry suspenders.

b. **COMBAT PACK.** The normal infantryman's combat pack is a webbing trapezoid with a removable bag buttoned to the bottom. A single strap on the top half of the web frame is used to attach the mess kit and two straps at the bottom hold the shelter quarter, tightly rolled, over the small bag. There are hooks at all four corners so that the combat pack may be attached to the infantry cartridge-belt suspenders. A small pocket on the inside of the bag flap holds the rifle-cleaning kit. Normally the tent rope, one day's iron rations, and a sweater are carried in the bag. However, many times the rope, tent pole, and pins are carried rolled inside the shelter quarter. If necessary a horseshoe roll of overcoat or possibly a blanket may be attached to the combat pack by three straps, which run through the rectangular eyelets on the top and on each side of the pack.

c. **MESS KIT.** The mess kit, formerly aluminum but now made of enameled steel, is usually carried on the combat pack, although it is sometimes attached to the bread bag in the same way as the canteen. Similar to the Russian and Japanese mess kit, it consists of a kind of deep pot with a cover which may be inverted for use as a plate.

d. **SHELTER QUARTER.** The German shelter quarter serves both as a tent and as a poncho. It is highly water-repellent duck cut in the form of

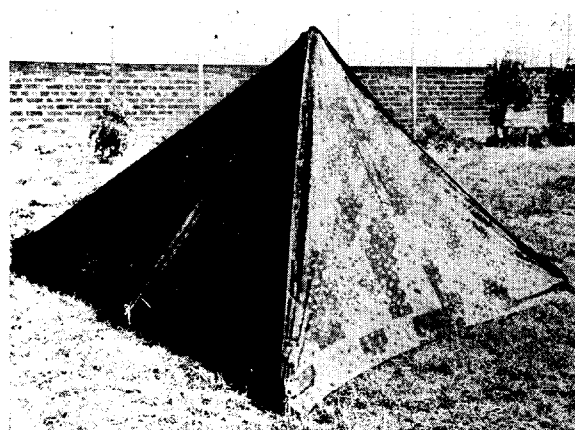


Figure 26.—Four shelter quarters pitched as a pyramidal tent. These carry the Waffen-SS camouflage pattern.

an isosceles triangle about 6 feet 3 inches along the base and 8 feet 3 inches along the other two sides. There are buttons and buttonholes on all three edges. The shelter quarter is covered with a camouflage mottle, either the characteristic army camouflage pattern or the usual *Waffen SS* pattern. Some have different patterns on each side, greens predominating on one side and browns on the other. Each soldier also is issued two tent pins and one tent-pole section for use when the shelter quarter is made into a tent. Ordinarily four men pitch their sections together to make a small pyramidal tent, but other combinations are possible, the most common of which are eight- and 16-man tents. The eight-man tent is constructed by erecting two three-sided pyramids and buttoning an inverted shelter half in the space between them. The 16-man tent is made by joining four of the long sides of the eight-man tent. A regular, four-section, pyramidal tent is erected on this base. This tent stands over 9 feet high. Worn as a poncho, the shelter quarter provides good protection from rain because of its excellent water-repellent property. The soldier's head can be thrust through a slit with the narrow point of the triangle in front. The two rear points are brought forward and buttoned together. Slits are left open for the arms, around which the poncho drapes almost as if it has sleeves. Motorcyclists can fasten the shelter quarter around the thighs.

3. Other Packs

a. **MODEL 39 HAVERSACK.** Troops to whom the combat pack is issued also receive the Model 39 haversack. This square-shaped canvas pack, reinforced with leather, has no attached shoulder



Figure 27.—The shelter quarter worn as a poncho. A *Waffen-SS* quarter is shown.

straps. It is attached to the infantry cartridge-belt suspenders by four hooks like those on the combat pack. Service shoes, twill trousers, a set of brushes, and other necessary items are carried in the main section of the pack. Towel, socks, sewing kit, and shirt are carried in the flap pouch. The tent-pole section and two tent pegs are carried at the top of the pack between the main pouch and the flap pouch. The overcoat or a blanket may be carried on the pack in a horseshoe roll. If for some reason both the haversack and the combat pack have to be carried at the same time, the combat pack is hooked into the rings on the upper edge of the haversack flap and secured by the button snap on the flap.

b. MODEL 34 HAVERSACK. An older type of haversack still being issued to some German soldiers is the Model 34. This is similar to the Model 39, but is intended to carry all the soldier's equipment.

c. MOUNTAIN RUCKSACK. The duties and equipment of mountain troops require a more versatile pack than the haversack. The mountain rucksack is a large olive-drab sack with attached shoulder straps. There is a large pocket on the outside below the cover flap. Leather loops facilitate attaching articles to the outside. The rucksack rests lower on the back than the haversack.

d. *Luftwaffe* RUCKSACK. The design of the *Luftwaffe* rucksack is similar, though not identical, to that of the mountain rucksack. The chief difference is in color: the Air Force rucksack is blue-gray.

e. TROPICAL RUCKSACK. The tropical rucksack is simpler than the mountain and *Luftwaffe* rucksack. Hooks at the corners snap into rings on the cartridge belt suspenders.

f. ARTILLERY RUCKSACK. Artillerymen receive the artillery rucksack, consisting of a full marching pack and a combat pack.

g. SADDLEBAGS. Until July 1944 a pair of saddlebags was issued to each mounted soldier, but since then saddlebags are considered organizational equipment. It is probable that the supplies of the old Model 34 now are nearly exhausted. It is being replaced by large and small saddlebags. The large saddlebag is the "horse" pack. Its contents include mess kit, horseshoe, eight nails, four calks, calk fastener and hoof cleaner, surcingle, curry comb, horse brush, and pail. The small saddlebag, carried on the right just behind the rider, carries the soldier's personal

equipment. Sweater, iron rations, rifle-cleaning kit, toilet articles, tent rope, shoe-cleaning gear, and towel are carried inside the bag, while the shelter quarter is strapped to the outside. Fifteen rounds of ammunition are carried on the cover flap. This small saddlebag may be used as a combat pack if the rider must dismount. The hooks on the four corners snap into the rings of the cavalry cartridge-belt suspenders. The mess kit is removed from the large saddlebag and strapped to the outside of the small saddlebag when it is used as a combat pack.

h. ENGINEER ASSAULT PACK. One engineer assault pack is authorized for every five combat engineers. It is used with the infantry cartridge-belt suspenders and consists of a canvas pack worn on the back and two canvas pouches used in place of the regular cartridge pouches. Two smoke pots are carried in the top of the pack and a 3-kilogram boxed demolition charge in the bottom. In addition, the mess kit, which fits in a special pocket, and shelter quarter are carried in the pack. The pouches hold egg-shaped grenades with rifle ammunition in side pockets. There is a special pocket on the right pouch for a gas mask without carrier. The men to whom this assault pack is issued also receive Model 39 haversack.

4. Special Mountain Equipment

Special equipment issued to German mountain troops is very similar to civilian mountaineering equipment. Manila rope about $\frac{1}{2}$ inch in diameter is issued in 100-foot lengths for mountain climbing, but it, of course, serves many other purposes. The equipment of German mountain troops also includes ice axes, 10-point crampons which are strapped to boots for better traction on ice, pitons, snaplinks, steel-edged mountain skis with Kandahar type bindings, and small oval snowshoes. Small, light-weight, A-shaped tents are issued to mountain troops. Red avalanche cords, avalanche shovels, and avalanche probes are provided for rescue work.

5. Special Winter Equipment

Ski troops in flat country are issued lighter skis than those given mountain troops. Their skis are not steel-edged and have a special binding designed for cross-country travel. This binding clamps securely to a metal plate screwed to the bottom of a special wooden-soled canvas overboot. Since all the plates are the same size, the

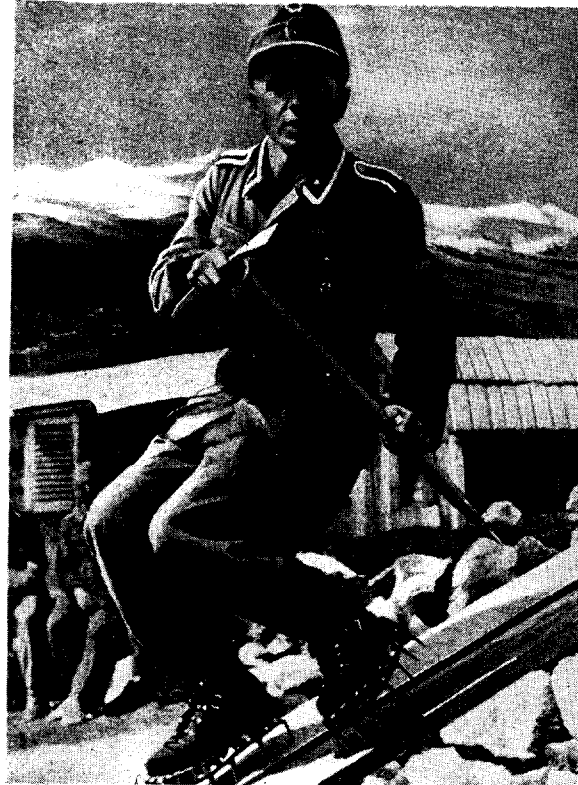


Figure 28.—A Waffen-SS mountain sergeant teaches the use of ice ax and crampons while simulating the descent of an ice slope. The crampons are strapped to ski-mountaineering boots.



Figure 29.—German pack frames for heavy weapons are specially designed for the loads they are intended to carry.

binding fits all men, making the skis interchangeable. Small sleds, known as akajas and looking like small 7-foot, flat-bottomed canoes, are used to transport supplies and heavy weapons and evacuate wounded across snow. There are three types: the double-end boat akaja, the weapons akaja, and the plywood akaja. Also, other types of sleds are improvised.

6. Miscellaneous Equipment

a. **DISPATCH CASE.** Platoon and squad leaders, master sergeants, messenger carriers, and similar personnel wear a black leather dispatch case on their belts. Previously this case was issued to a greater number, but in 1943 the issue was restricted to conserve leather. A leather map case with a plastic window fits inside the dispatch case. Several pockets are sewn on the front of the case to accommodate seven pencils, rules, map-reading instruments, and other equipment.

b. **PACK FRAMES.** Pack frames, which are used by German troops to carry heavy weapons and other heavy or clumsy loads, particularly in difficult terrain, are somewhat similar in appearance to the metal tube frames sometimes used with frame rucksacks. There is no universal type but rather special ones for each type of load with special tubes and shelves to accommodate the particular type of equipment carried.

c. **GOGGLES.** The commonest German goggles are the plastic-lens folding type, made with both clear and amber lenses, one of each type frequently being issued to each man. These are the "sun and dust goggles" which are issued to all members of motorized or mechanized units except vehicle drivers and motorcyclists, who receive a heavier model with smoke-colored lenses and leather, synthetic rubber, or felt frames. The heavier goggles are also issued to some anti-aircraft gunners and sometimes to mountain troops, although mountain troops frequently get the plastic goggles.

d. **FORK-SPOON.** A combination aluminum fork-spoon is issued to each German soldier. The handles of the fork and spoon are riveted together so that when extended the fork is on one end and the spoon on the other, but when folded the handles lie together and the tines of the fork rest in the bowl of the spoon. Since the over-all length folded is only $5\frac{1}{2}$ inches, this

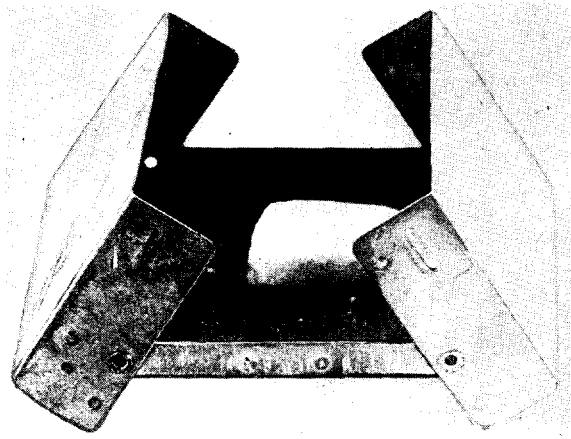


Figure 30.—Fuel tablet stove (*Esbit Kocher*) in half-open position. When closed, the box of *Esbit* fuel tablets fits inside and is fully protected against breakage.

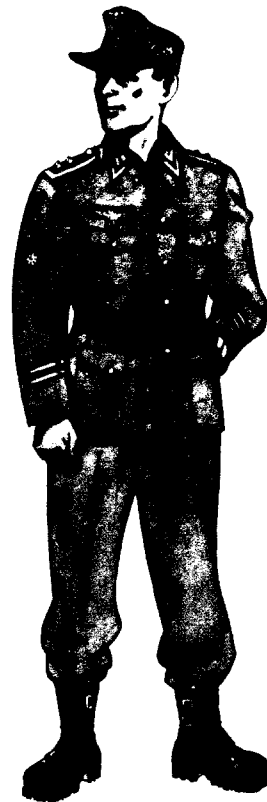
combination utensil is easily carried. It is much simpler and lighter than a combination stainless steel knife, fork, spoon, and sometimes can-opener issued to German troops during the African campaign.

e. **RATION HEATERS.** A small gasoline stove, weighing a little over a pound, is issued to special units such as mountain troops who must operate under difficult conditions but keep a high degree of mobility. This stove works by burning vaporized gasoline, but it has no pressure pump. Pressure is built up by heating the burner with gasoline or fuel tablets burnt in a small cup below the tank and maintained by the heat generated by the stove itself. More widely issued are fuel tablets, the commonest of which is *Esbit*: tablets of hexamethylene tetramine. The fuel is packed in a paper carton which is carried in the fuel-tablet stove (*Esbit Kocher*). In the carton there are four cakes of five tablets each, one or more of which may be broken from the cake and burned at a time. This fuel is extremely efficient. The fuel-tablet stove is made of three sections of zinc-coated steel. Two identical sections, which form the cover in the closed position, and the sides and mess kit support in the two open positions, are attached to a third section, by a grommet hinge. This third section is a shallow pan on which the tablets are burned. Dimples in the metal at appropriate positions hold the stove in either the closed, half-open, or open positions.

GERMAN ARMY UNIFORMS



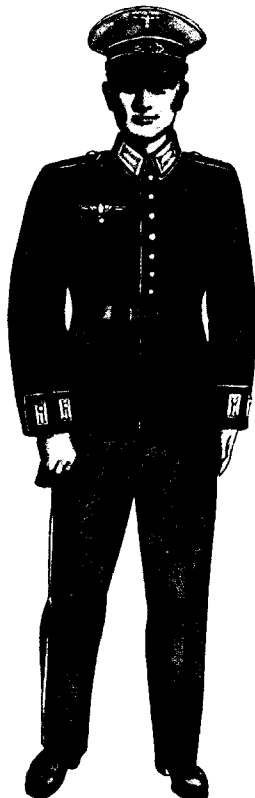
FIELD UNIFORM, ENLISTED MAN
Pvt; NCOs add braided edging to collar as shown on 1st sgt of Mountain Infantry.



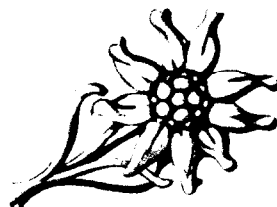
MOUNTAIN UNIFORM, NCO
1st sgt; double sleeve braid on sleeves differentiates 1st from master sergeants.



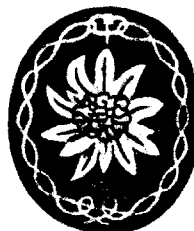
OVERCOAT, ALL RANKS
Fabrication; general officers wear red lapel facings and gold buttons.



SERVICE DRESS, ENLISTED MAN
Pvt 1st class; parade uniform consists of same uniform with marching boots.



MOUNTAIN TROOPS' CAP BADGE
Worn on the left side of the cap.



MOUNTAIN TROOPS' SLEEVE BADGE
Worn on the right sleeve of coat and overcoat.



PARADE DRESS, NCO
Cavalry; 1st card is marksmanship award for non-commissioned officers and men.

GERMAN ARMY UNIFORMS



SERVICE DRESS, OFFICER

Lt Col; coat is re-made Reichwehr coat; normal service coat resembles EM's.



FIELD UNIFORM, OFFICER

Maj artillery; the Reichwehr coat may also be worn as an ordinary field coat.



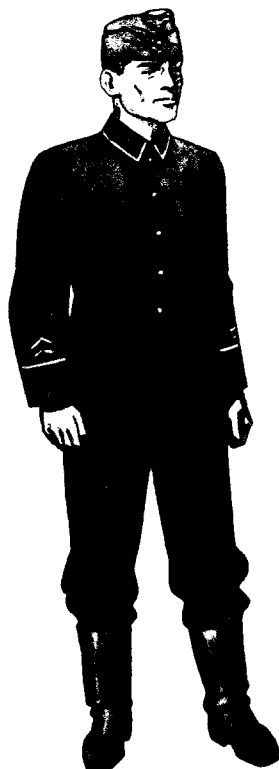
BLACK PANZER UNIFORM

2nd Lt; worn by tank crews and by certain tank destroyer and engineer crews.



FIELD GRAY JACKET

As worn by SP infantry gunners; ID and assault gunners wear skulls on collar patches.



FATIGUE UNIFORM

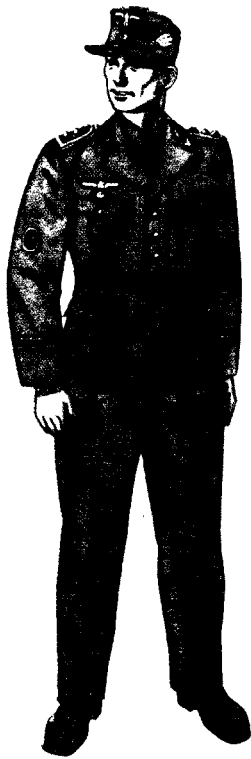
Master sergeant; fatigues are issued in several colors, including white and black.



MOTOR VEHICLE COAT

Sgt; motorcycle crew; covers the lower part of the uniform.

GERMAN ARMY UNIFORMS



SUMMER UNIFORM

1st Sgt of Jager troops; uniform may consist of shorts, shirt and tropical helmet.

JAGER TROOPS CAP BADGE
Worn on the left side of the cap.JAGER TROOPS SLEEVE BADGE
Worn on the right sleeve of the coat and overcoat.

CAMOUFLAGE JACKET

This jacket resembles the SS pullover jacket, but is different in color scheme.



MOUNTAIN WINDJACKET

Worn by mountain and Jager troops and by mountaineers of the German Labor Service.



MOUNTAIN PARKA

This reversible windproof, water-repellant uniform has a white and tan side.



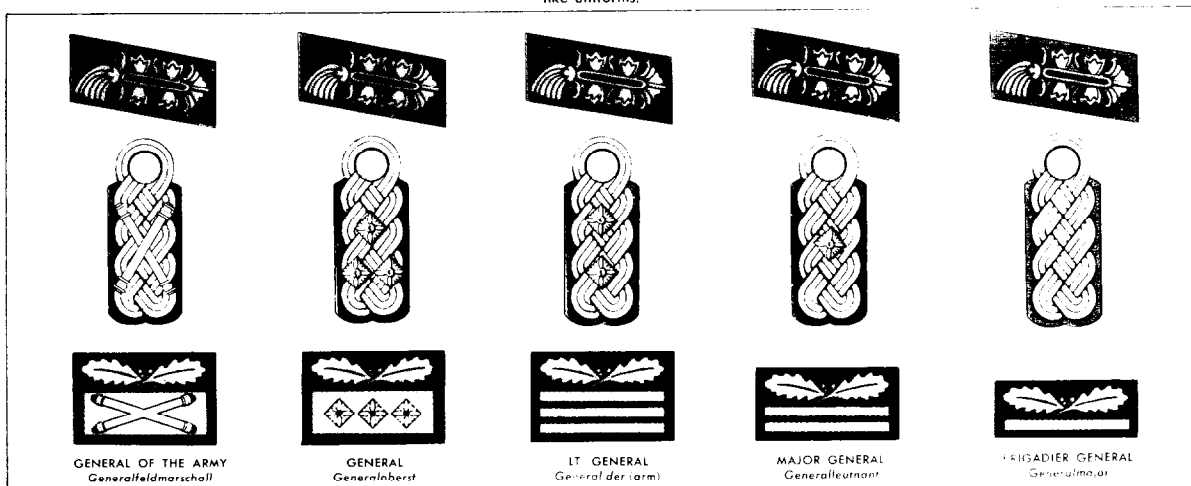
WINTER UNIFORM

This reversible uniform has the reverse side in plain or in various color patterns.

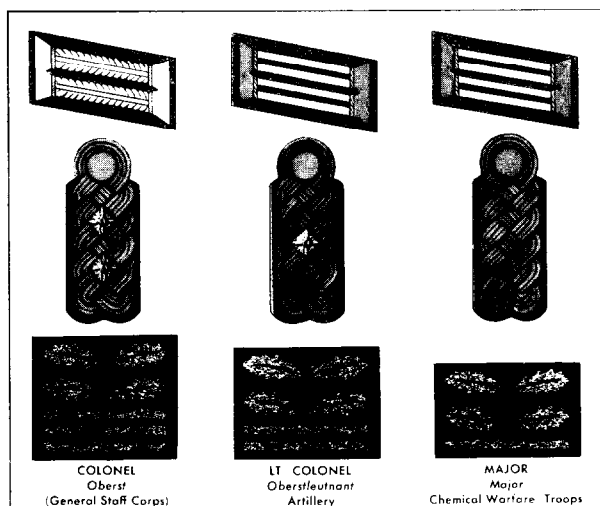
GERMAN ARMY: INSIGNIA OF RANK

Shoulder straps are the main indication of rank. Noncommissioned officers (Unteroffiziere) are further distinguished by a braided edge to the collar of their service, field, and fatigue coats. Certain noncommissioned officers may wear officers' uniforms and dispense with the braided collar edging. Illustrated below are (top to bottom) collar patch, shoulder strap, and the type of rank insignia worn on both sleeves of overalls, winter suits and like uniforms.

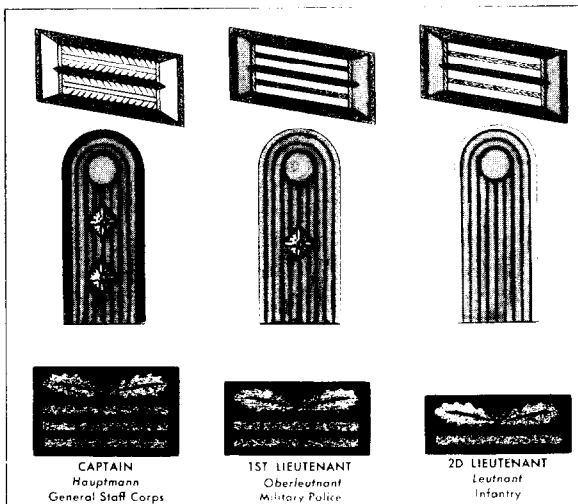
GENERAL OFFICERS (Generale)



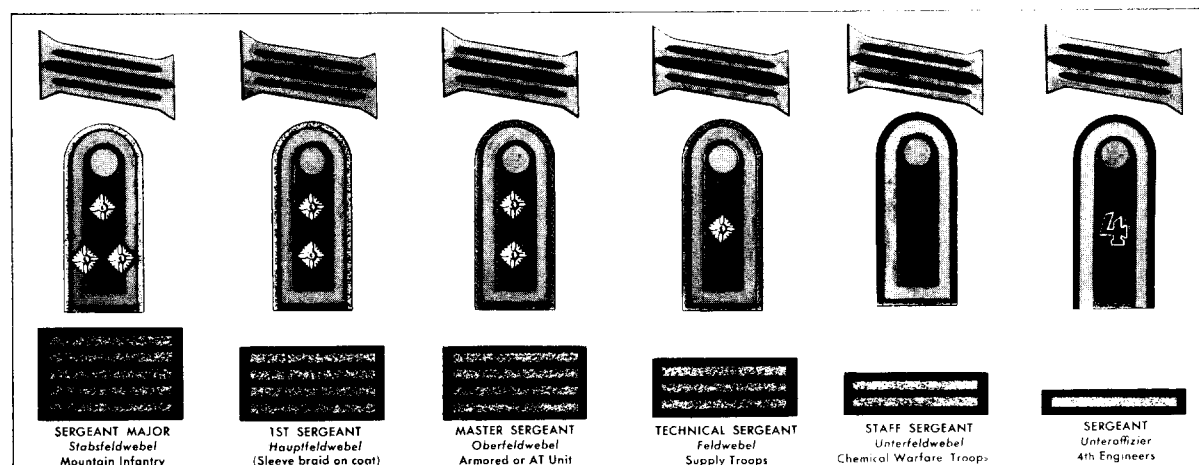
FIELD OFFICERS (Stabsoffiziere)



COMPANY OFFICERS



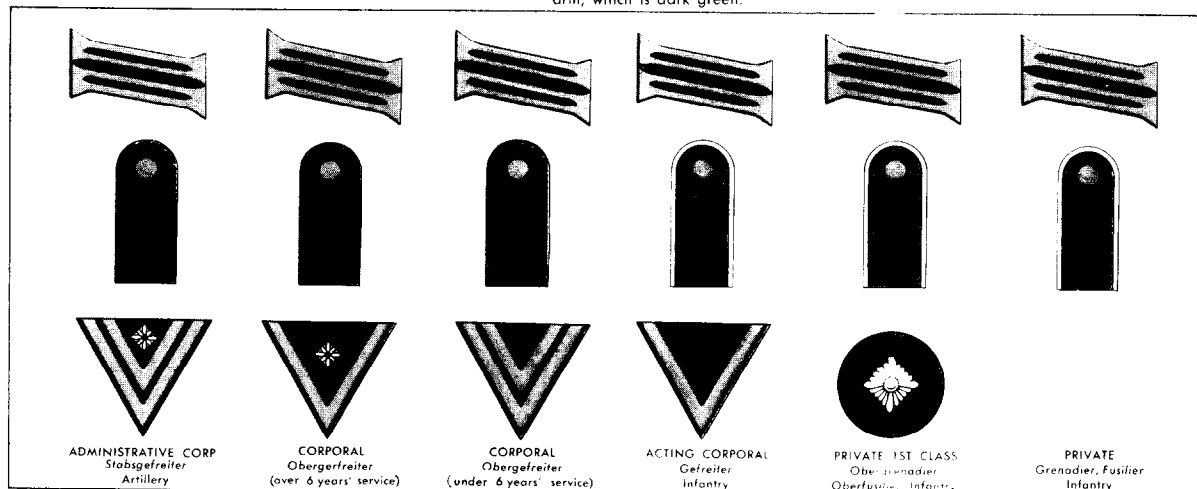
NONCOMMISSIONED OFFICERS (Unteroffiziere)



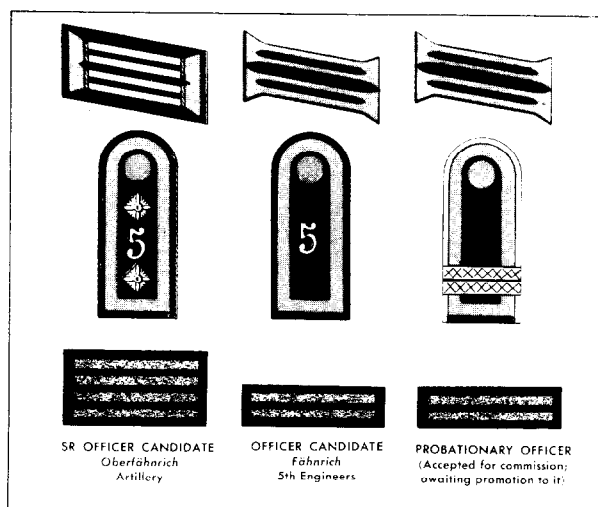
GERMAN ARMY: INSIGNIA OF RANK

ENLISTED MEN

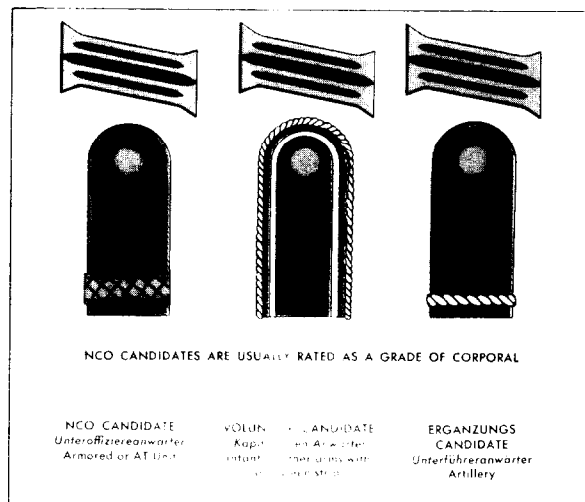
Corporals in the German Army are not rated as noncommissioned officers, but are placed among what amount to several grades of privates. These grades may wear the sleeve insignia shown below (chevrons or pip) on the coat, overcoat, fatigues, and on other types of uniform. There are many classes of administrative officials; examples of a few typical ranks and classes are shown. Such officials may be distinguished by their basic color of arm, which is dark green.



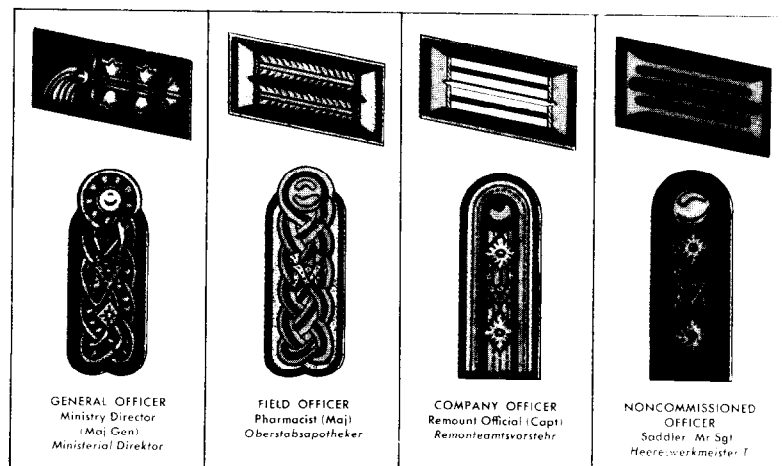
OFFICER CANDIDATES



NONCOMMISSIONED OFFICER CANDIDATES



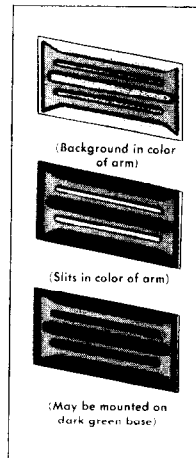
ADMINISTRATIVE OFFICIALS — Typical rank insignia



CHAPLAINS



OBSOLETE COLLAR PATCHES



GERMAN ARMY: COLORS OF THE ARMS



Colors are the basic indication of arms (there are no services in the German Army). Color of arm is usually to be found on shoulder straps, on the service cap, on old-style field caps, and on collar patches of line officers' field uniforms, and on collar patches of service and dress uniforms. Piping in the color of arm appears on service and dress coats and trousers. In the instances recorded at right, letters on the shoulder strap indicate either a separate arm using the same color as another arm, or else a further subdivision of function within an arm. Numbers and letters may also be used to designate units.

	Bright Red GENERALS Generale		Pink with J on Straps MOTOR MAINTENANCE TROOPS Kraftfahrparktruppe		White with GW on Straps MORTAR BATTALIONS Granatwerferbattalione
	Bright Red ARTILLERY HEAVY AA Artillerie, Heeresflak		Wine Red SPECIALIST SERVICE, JAGD Truppensonderdienst, Wehrmachtrichter		White with F on Shoulder Straps LIGHT ARMY AA Heeresfla
	Crimson GENERAL STAFF CORPS Generalstab		Orange Red MILITARY POLICE Feldgendarmarie		Bordeaux CHEMICAL WARFARE TROOPS Nebeltruppen
	Crimson VETERINARY PERSONNEL Veterinär-Korps		Orange ORDNANCE		Violet CHAPLAINS Heeresgeistliche
	Pink TANK REGTS & BNS Panzerregimenter und Abt		Gold Yellow RCN BNS, CAV SQDNS (Inc Cyclist Bns) Aufklärungs Abt, Kavallerie Schwadronen		Light Blue TRANSPORT & SUPPLY TROOPS Fahrttruppen, Nachschutruppen
	Pink TD BNS & UNITS (except of Gren Regts) Pz Jäg Abt und Einheiten		Gold Yellow 24th PZ DIV Armd & Armd Inf Regt, Armd Rcn Bn		Light Blue with Caduceus on Straps SP SERV, ADMIN & PAYMR BRS
	Pink MOBILE BNS (except Cav & Cyclist) Schnelle Abteilungen		Lemon Yellow SIGNAL TROOPS Nachrichtentruppen		Dark Blue MEDICAL PERSONNEL Sanitätspersonal
	Pink ARMED RCN BNS, (Inc Motorcyclist Bns) Panzeraufklärungs Abt		Light Green MTN & LT INF Gebirgsjäger und Jäger		Black COMBAT & CONST ENGINEERS Pioniere, Baupioniere
	Pink HV TD BNS & UNITS Schwere Pz Jäg Abt und Einheiten (Formerly Assault Guns Bns & Units)		Gloss Green ARMORED INFANTRY Panzergranadiere (Inc. integral SP Inf Gun Units)		Gray Blue SPECIALIST OFFICERS Sonderführer im Offiziersrang
	Pink with F on Straps ARMORED TRAINS Eisenbahn Panzerzüge		White INFANTRY Granadiere, Fusiliere Inc Mtz Inf & Integral SP Inf Guns		Light Grey PROPAGANDA TROOPS Propagandatruppen

SPECIALIST INSIGNIA: OFFICERS AND NCOs









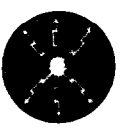



















Specialist officers and senior NCOs of the arms may wear special symbols on their shoulder straps in addition to the color of their arm. Specialist officers appointed because of special qualification (Sonderführer) wear such symbols only if they are medical officers; otherwise they wear the collar patch shown above, and the type of insignia of rank shown at right.

	FORTRESS ENGINEER WOs Festungswerkmeister		FORTRESS ENGINEERS Festungspioniere		VETERINARIAN Veterinär		MEDICAL PERSONNEL Sanitätspersonal
	FARRIER WO Hufbeschlaglehrmeister		MUSICIAN OFFICERS Musikinspizienten, Musikmeister		JAGD, SPECIALIST SERVICE Wehrmachtrichter		ADMIN AND PAYMR BNS SPECIALIST SERVICE Intendantur und Zahlmeisterdienst
	BATTALION GRADE SONDERFÜHRER Abteilungsführer		COMPANY GRADE SONDERFÜHRER Kompanieführer		PLATOON GRADE SONDERFÜHRER Zugführer		SPECIAL MEDICAL LT Kriegsarzt







GERMAN ARMY: SPECIALTY BADGES (NCOs and Enlisted Men)

The following badges are worn on the lower right arm of the coat and overcoat. The system of designation illustrated on the first three farrier badges applies to the various other specialty badges, the lozenge insignia being peculiar to farrier instructors. The new specialty badge for supply sergeant is based on unconfirmed reports, but the design is believed to be approximately accurate.

<p>The following badges are worn on the lower right arm of the coat and overcoat. The system of designation illustrated on the first three farrier badges applies to the various other specialty badges, the lozenge insignia being peculiar to farrier instructors. The new specialty badge for supply sergeant is based on unconfirmed reports, but the design is believed to be approximately accurate.</p>					
		FARRIER NCO specialist within organizational quota <i>Hufbeschlagmeister</i>	FARRIER Who has passed his tests <i>Hufbeschlagmeister</i>	FARRIER NCO over unit specialist quota; EM specialist within quota <i>Hufbeschlagmeister</i>	FARRIER INSTRUCTOR <i>Hufbeschlaglehrmeister</i>
					
MEDICAL ENLISTED PERSONNEL <i>Sanitätsunterpersonal</i>	ORDNANCE SERGEANT <i>Waffenunteroffizier</i>	PYROTECHNICIAN <i>Feuerwerker</i>	TRANSPORT SERGEANT <i>Schirmmeister</i>	RADIO SERGEANT <i>Funkmeister</i>	PIGIONEER <i>Brieftaubemeister</i>
					
FORTRESS ENGINEER SERGEANT <i>Festungspanier-Feldwebel</i>	FORTIFICATION MAINTENANCE SERGEANT <i>Wallfeldwebel</i>	PAYMASTER CANDIDATE <i>Zahlmeisteranwärter</i>	SADDLER CANDIDATE <i>Truppensattlermeister- anwärter</i>	FORTRESS CONSTRUCTION SERGEANT <i>Festungswerkfeldwebel</i>	SUPPLY SERGEANT (Inf and Arty Equipment) <i>Gerätverwaltungsunteroffizier</i>
<p>The following specialty badges are also worn on the lower right arm of the coat and overcoat. While candidates may wear the strip of candidate's braid (see farrier candidate above), they do not follow the same system of designation by braided edging as do the specialists above. The sniper's badges are partly insignia of specialty, and partly rewards for actual achievement in combat. They are to be worn over any other specialty badges worn on the lower right arm.</p>					
					
		MOTOR OR ARMED MECHANIC 2D CLASS <i>Kraftzeug, Panzerwärter II</i>	MOTOR OR ARMED MECHANIC 1ST CLASS <i>Kraftzeug, Panzerwärter I</i>	MOTOR OR ARMED CRAFTSMAN <i>Handwerker</i>	SKILLED MOTOR OR ARMED CRAFTSMAN <i>Vorhandwerker</i>
					
SNIPER <i>Scharfschütze</i> (At least 20 enemy killed)	SNIPER <i>Scharfschütze</i> (At least 40 enemy killed)	SNIPER <i>Scharfschütze</i> (At least 60 enemy killed)	GAS DEFENSE SERGEANT <i>Gasschützunteroffizier</i>	SIGNAL MECHANIC <i>Nachrichten-Mechaniker</i>	SIGNAL MECHANIC SERGEANT <i>Nachrichten- Mechanikerunteroffizier</i>

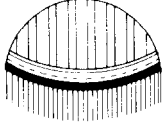



WORN ON LOWER LEFT ARM

UPPER LEFT ARM

					
GUNNER (Artillery) <i>Richtkanonier</i>	GUNNER (Chemical Warfare Troops)	SIGNAL PERSONNEL Symbol color changes with arm (Here Artillery)	RADIO MECHANIC (Armored Troops) <i>Panzerfunkwarte</i>	ENGINEER ASSAULT BOAT COXWAIN <i>Steuermann</i>	MILITARY POLICE <i>Feldgendarmarie</i> (Officers: silver eagle)

MUSICIAN'S BADGES (On both shoulders)

MARKSMANSHIP AWARDS: (Pz Tps substitute tank for swords)

			
BUGLER <i>Bataillonshornist</i> Signal Troops	MUSICIANS <i>Musiker</i> Artillery	FIFE AND DRUM CORPSMAN <i>Spilleute</i> Transport Troops	Cord color, shield design, and number of acorns (shells for artillery) vary to produce 12 grades. Fourth grade shown.

GERMAN AIR FORCE UNIFORMS

UNCLASSIFIED



FIELD UNIFORM, EM, FRONT

Pvt; older style coat as shown may be worn by officers, NCOs, and enlisted men.



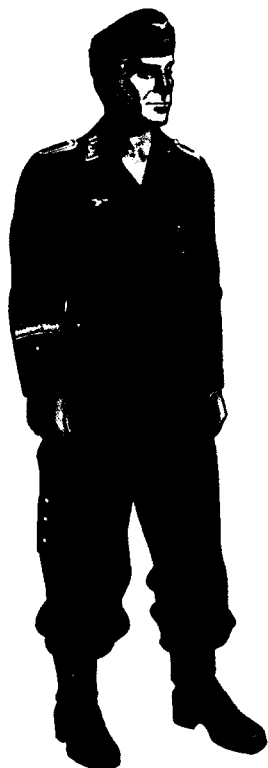
FIELD UNIFORM, EM, REAR

Pvt; equipment carried is similar to that of the German Army, except for color.



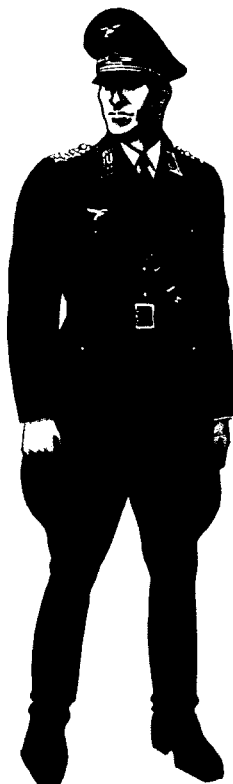
MOUNTAIN UNIFORM, NCO

Staff sgt; officers wear silver piping along top edge of the mountain cap turnup.



PARACHUTIST'S UNIFORM

Staff sgt; the "flight blouse" shown may be worn by all types of GAF personnel.



SERVICE DRESS, OFFICER

Colonel; GAF personnel may wear this coat with the collar buttoned at the neck.



OVERCOAT

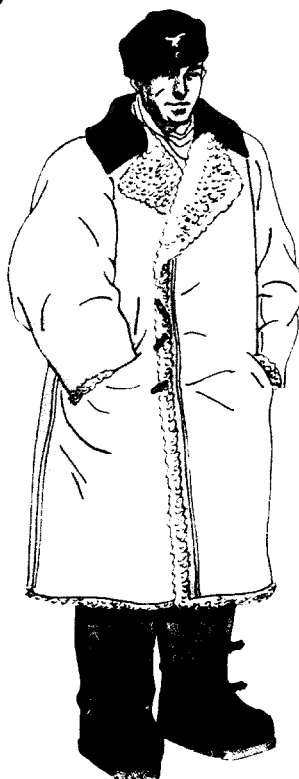
Staff sgt; this overcoat is worn with appropriate insignia by all GAF personnel.

GERMAN AIR FORCE UNIFORMS



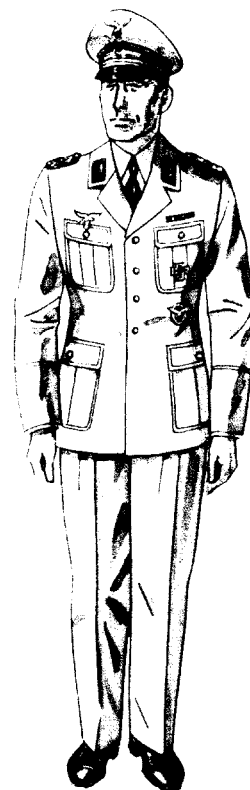
SUMMER UNIFORM

Sgt; breeches may replace trousers shown. Shirt and shorts may also be worn.



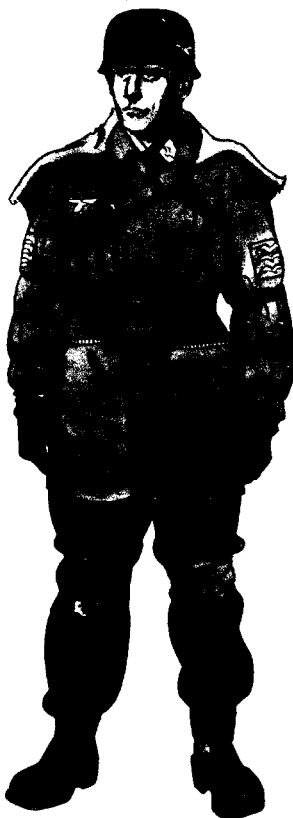
WINTER OVERCOAT

This heavy sheepskin overcoat is worn by sentries and men manning static defenses.



SUMMER UNIFORM, OFFICERS

Uniform, either whole or with gray trousers may be worn by fliers.



PARACHUTIST JUMP SUIT

Tech Sgt; other similar types, both plain and camouflaged, may be encountered.



FIELD JACKET

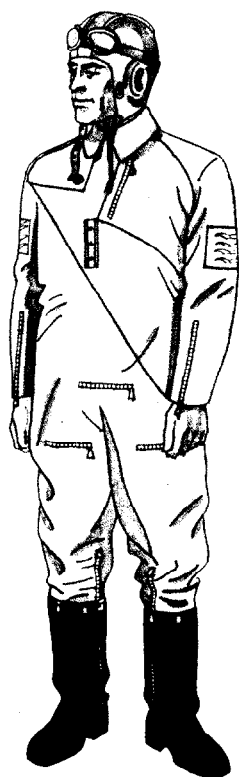
First sergeant; this jacket is usually worn by members of parachute divisions.



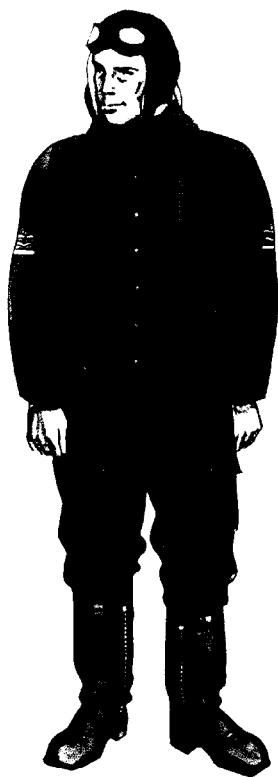
FATIGUE SUIT

Acting pilot; this uniform is issued in cream, green, tan, and blue covered cloth.

GERMAN AIR FORCE UNIFORMS



LIGHT FLYING SUIT
Master or 1st sergeant; insignia of rank is worn on both sleeves of flying suits.



LINED FLYING SUIT
1st lieutenant; the suit illustrated is typical of the various lined flying suits.



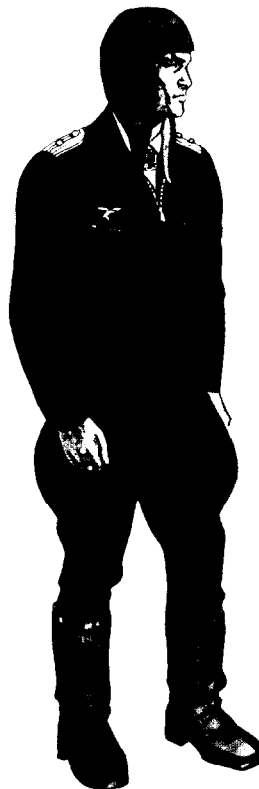
FATIGUE OVERALL
Tech sgt or sgt 2 bars; sgt 3 bars; sgt maj 3 bars with a pilot's wings.



SUMMER MOTORING COAT
2d lieutenant; NCOs wear the type of rank insignia worn on their fatigue coveralls.


















STANDARD MOTORING COAT
This coat may be buttoned in the same manner as the summer motoring coat at left.



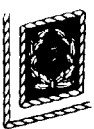

















FLIER'S LEATHER JACKET
1st lt or senior NCOs or officers may wear leather flying jackets of this type.

GERMAN AIR FORCE: INSIGNIA OF RANK (Collar patch, shoulder strap, and coverall insignia) **GENERAL OFFICERS** (Generale)









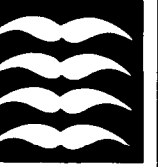


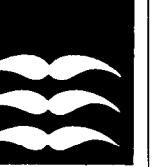






   <p>GENERAL OF THE ARMY Generalfeldmarschall</p>	   <p>GENERAL Generaloberst</p>	   <p>LT GENERAL General der 1. Arm</p>	   <p>MAJOR GENERAL Generalleutnant</p>	   <p>BRIGADIER GENERAL Generalmajor</p>
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FIELD OFFICERS (Stabsoffiziere)

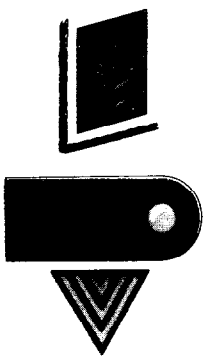
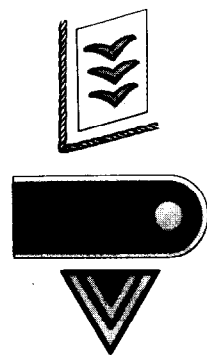
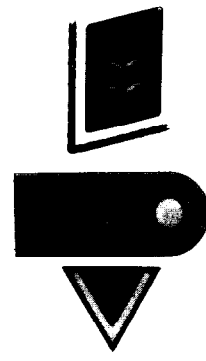
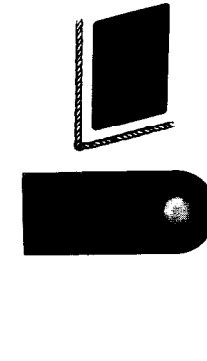
COMPANY OFFICERS

   <p>COLONEL Oberst 22nd Flak Regt</p>	   <p>LT COLONEL Oberstleutnant General Staff Corps</p>	   <p>MAJOR Major Civilian Air Traffic Control</p>	   <p>CAPTAIN Hauptmann 6th Flak Regt</p>	   <p>1ST LIEUTENANT Oberleutnant Flying Troops</p>	   <p>2D LIEUTENANT Leutnant Signal Corps</p>
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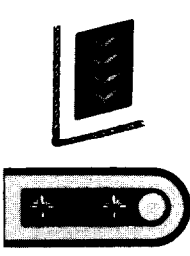
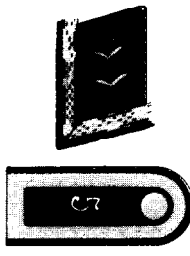
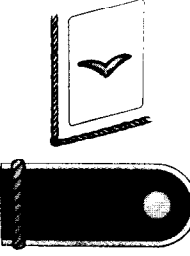
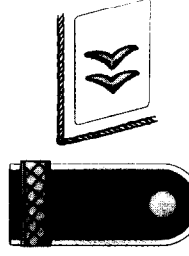
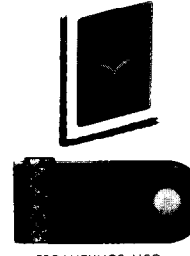
NONCOMMISSIONED OFFICERS—TITLES: } Antiaircraft: Hauptwachmeister, Oberwachmeister, Wachmeister, Unterwachmeister } Other Units: Hauptfeldwebel, Oberfeldwebel, Feldwebel, Unterfeldwebel

   <p>SERGEANT MAJOR Stabsfeldwebel Flying Troops</p>	   <p>1ST SERGEANT Hauptwachmeister 1st Flak Regt</p>	   <p>MASTER SERGEANT Oberfeldwebel Signal Troops</p>	   <p>TECHNICAL SERGEANT Feldwebel Civilian Air Traffic Control</p>	   <p>STAFF SERGEANT Unterwachmeister 3d Flak Regt</p>	   <p>SERGEANT Unteroffizier Flying Troops</p>
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GERMAN AIR FORCE: INSIGNIA OF RANK**ENLISTED MEN**

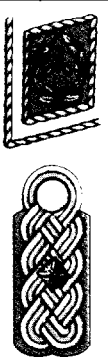
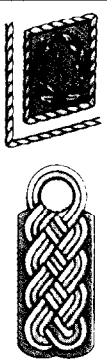
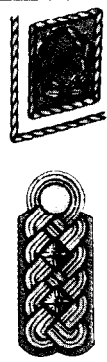
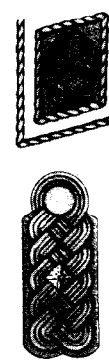
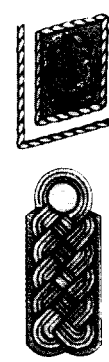
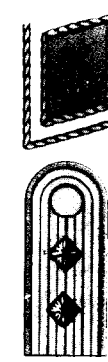
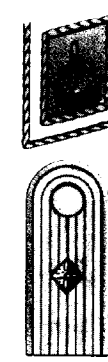
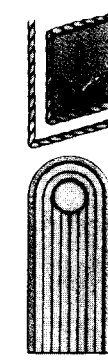
			
SENIOR CORPORAL Hauptgefreiter Flak Troops	CORPORAL Obergefreiter Flying Troops	ACTING CORPORAL Gefreiter Signal Troops	PRIVATE Bausoldat Construction Troops

OFFICER CANDIDATES**NCO CANDIDATES**

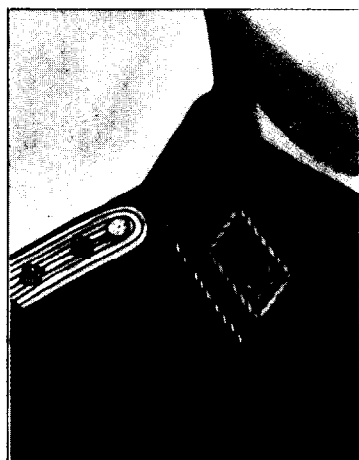

















				
SENIOR OFFICER CANDIDATE Oberfähnrich Construction Troops	OFFICER CANDIDATE Fähnrich 5th Flak Regt	VOLUNTEER OFFICER CANDIDATE Fähnjunker (May be any rank)	NCO CANDIDATE Unteroffizieranwärter (Here Gefreiter)	ERGÄNZUNGS NCO CANDIDATE Unterführeranwärter

GERMAN AIR FORCE: ENGINEERING CORPS**(ADMINISTRATIVE OFFICIALS)**

Engineers having to do with mechanical engineering in the German Air Force belong to a special corps and are distinguished by special rank insignia and special designations of rank. All ranks wear pink as color of their service

							
MAJOR GENERAL Flieger-General- stabsingenieur	BRIGADIER GENERAL Flieger- Generalingenieur	COLONEL Flieger- Oberstingenieur	LT COLONEL Flieger- Oberstabsingenieur	MAJOR Flieger- Stabsingenieur	CAPTAIN Flieger- Hauptingenieur	1ST LIEUTENANT Flieger- Oberingenieur	2D LIEUTENANT Flieger-Ingenieur





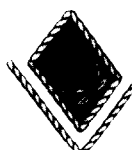









GERMAN AIR FORCE: COLORS OF THE ARMS AND SERVICES

		White GENERALS Generäle		Crimson GENERAL STAFF Generalstab		Black CONSTRUCTION TROOPS Luftwaffenbauverbände
		Gold Yellow FLYING TROOPS Fliegertruppe		Bright Red ANTI-AIRCRAFT ARTILLERY Flak	ADMINISTRATIVE OFFICIALS Only three service colors shown:	
		Gold Yellow FLYING TROOPS Fallschirmtruppe		Bright Red ORDNANCE OFFICERS Offiziere des Waffenwesens		Dark Green-White GENERAL OFFICER OFFICIALS
		Gold Yellow SUPPLY SERVICES Nachschubeinheiten		Gold Brown SIGNAL TROOPS Luftnachrichtentruppen		Pink GAF ENGINEERING CORPS Ingenieurkorps der Luftwaffe
		Gold Yellow ARMY AND NAVY PERSONNEL DETACHED IN THE GAF		Light Green CIVILIAN AIR TRAFFIC CONTROL Reichsluftaufsicht dienst		Light Blue-Pink GAF NAVIGATION CORPS Nautikerkorps
		Orange RECALLED OFFICERS Offiziere zur Dienstleistung		Dark Blue MEDICAL PERSONNEL Sanitätspersonal		Pink Gold Yellow PILOTS CORPS Fliegerführerkorps



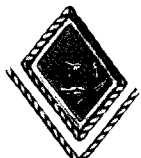







While line arms and services wear the same color on both shoulder strap and collar patch, note that all but one of the divisions of the Corps of Administrative Officials wear two colors. The basic color for most Administrative Officials is dark green.

SONDERFÜHRER










Specialist officers and NCOs, awarded commissions or ratings because of special qualifications.

						
						
COLONEL Oberst	MAJOR Major	CAPTAIN Hauptmann	1ST LIEUTENANT Oberleutnant	2D LIEUTENANT Leutnant	ACTING 1ST SGT Hauptfeldwebel dienstver.	SQUAD LEADER Gruppenführer


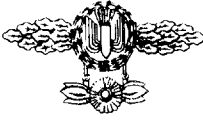

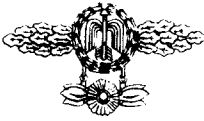

TYPICAL ADMINISTRATIVE OFFICIALS

				
				
GENERAL OFFICER Ministry Director (Maj Gen) Ministerial Direktor	FIELD OFFICER Weather Serv Officer (Maj) Oberamtmann	COMPANY OFFICER Pilot: 1st Lt. Oberfliegerführer	WARRANT OFFICER Fireman: WO Unterbrandmeister	NONCOMMISSIONED OFFICER JAGD Inspector (Mr Sgt) Justizoberwachmeister































GERMAN AIR FORCE: BADGES OF SPECIALTY—Worn on lower left breast

					
PILOT	OBSERVER	PILOT AND OBSERVER	AIR GUNNER RADIO OPERATOR	AIR GUNNER FLIGHT ENGINEER	AIR CREW MEMBER (Uncertified as gunner)
		AWARDS The following awards are for the type of service indicated. They are worn in the same place as the specialty badges above.			
GLIDER PILOT	AIR FORCE PARACHUTIST			WORLD WAR I FLIERS	GROUND COMBAT BADGE
					ANTIAIRCRAFT BADGE

AWARDS FOR OPERATIONAL FLIGHTS—Worn on upper left breast. Awarded in gold, silver, bronze; laurel pendant may be added to gold awards, as shown.

				
RECONNAISSANCE	BOMBER	ATTACK	FIGHTER	TRANSPORT

SPECIALTY BADGES—Worn on lower left sleeve by NCOs and men

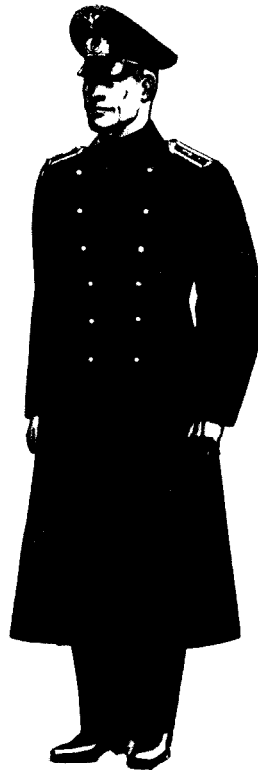
					
AUTOMOTIVE EQUIPMENT ADMINISTRATORS (Band for candidates)	MEDICAL PERSONNEL Sanitätspersonal	SEARCHLIGHT EQUIPMENT ADMINISTRATORS Scheinwerfergerätverwalter	SIGNAL EQUIPMENT ADMINISTRATORS Luftnachrichtengerätverwalter	PYROTECHNICIANS Feuerwerker	FLAK ORDNANCE SGTS Waffenunteroffiziere
					
OTHER ORDNANCE SGTS Waffenunteroffiziere	AIRCRAFT EQUIPMENT ADMINISTRATORS Flugzeuggerätverwalter	GRADS OF TECH PREP SCHOOLS	TELEPHONE OPERATORS Fernsprecher	TELEPHONE SERGEANTS Fernsprechunteroffiziere	TELETYPE OPERATORS Fernschreiber
					
TELETYPE SERGEANTS Fernschreibunteroffiziere	AIR RAID WARNING PERSONNEL Flugmeldpersonal	RADIOMEN Funkler	RADIO SERGEANTS Funkunteroffiziere	RADIO DIRECTION FINDERS Peilfunkler	RADIO DIRECTION FINDER SGTS Peilfunkunteroffiziere
					
RADIO INTERCEPTORS Horchfunker	RADIO INTERCEPTION SGTS Horchfunkunteroffiziere	TECHNICAL AVN PERSONNEL Fliegeertechnisches Personal	PERSONNEL OF TENDERS, CRASH BOATS, ETC Seemannisches Bootspersonal	FLYING PERSONNEL Fliegendes Personal	FLAK PERSONNEL (For 9 months' service)
					
RANGEFINDER CREWS Entfernungsmassleute (Gold border for 1 yr serv)	SOUND LOCATOR CREWS Horchler	SOUND LOCATOR CREWS (For over 1 year's service)	MOTOR VEHICLE DRIVER Kraftfahrer	ADMIN SGTS & TECH SGTS Verwaltungsunteroffiziere und Feldwebel	SIGNAL PERSONNEL NON-SIGNAL UNITS Truppennachrichtenpersonal

GERMAN NAVY UNIFORMS



BLUE UNIFORM

Worn by officers, warrant officers, chief and 1st class petty officers; Lt (jg) shown.



OVERCOAT

Worn by officers, warrant officers, chief and 1st class petty officers; BM 1-C shown.



BLUE UNIFORM

Worn by 2nd and 3d class petty officers and seamen. May be fitted with striped collar.



PEAJACKET

Worn by 2d and 3d class petty officers and seamen. Note collar patch for BM 2/C.



KHAKE UNIFORM

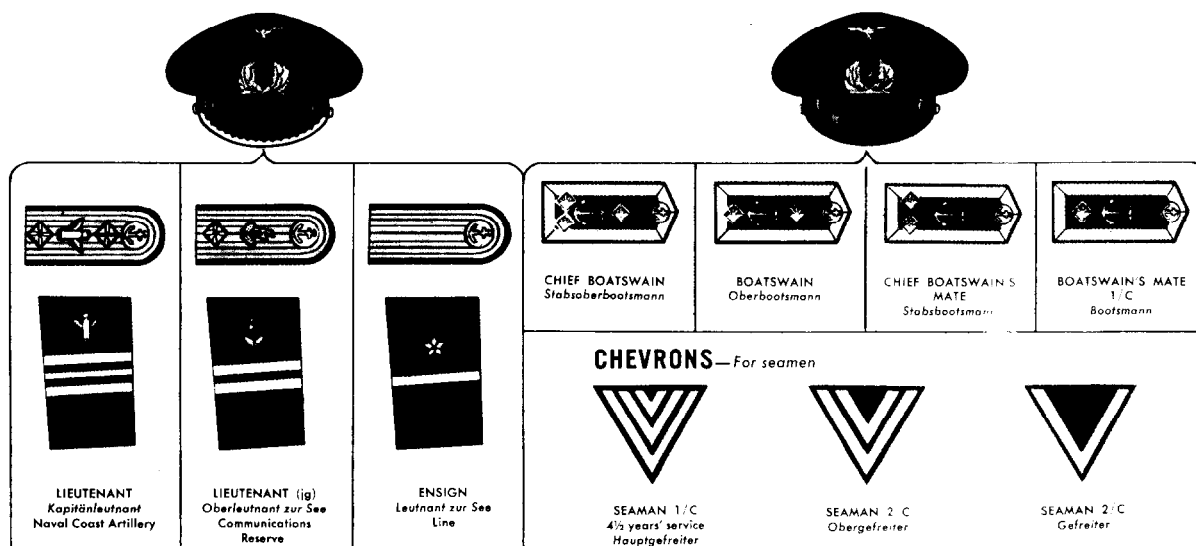
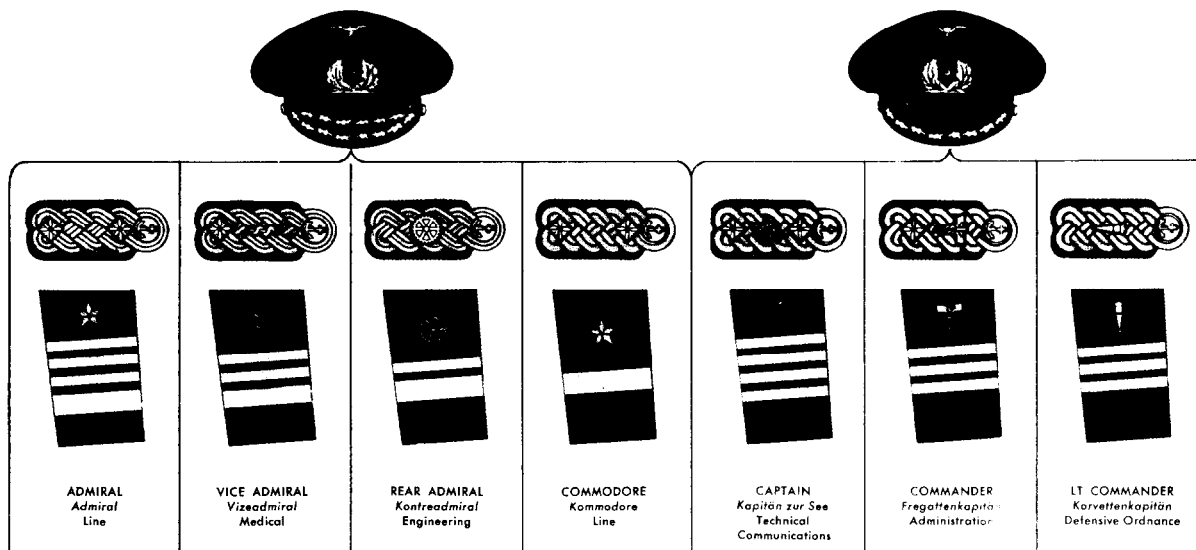
Worn by all personnel of the German Navy. Rank insignia for BM 1-C is shown on shirt.



ADMINISTRATIVE OFFICIAL

Administrative officials wear normal blue uniform with silver replacing gold insignia.

GERMAN NAVY—INSIGNIA OF RANK FOR BLUE AND WHITE UNIFORMS



PETTY OFFICERS 2 AND 3/C

These POs wear their corps insignia on oval badges as below. These are their insignia of rank. Boatswains wear single anchors and quartermasters wear crossed anchors as corps insignia; other corps wear devices shown at right. Note that in seaman's branch, a star replaces the boatswain's anchor.



BOATSWAIN'S MATE
2/C
Oberbootsmannsmaat



COXWAIN
Bootsmannsmaat

SEAMAN'S SPECIALITY BADGES—*Mounted on ovals for POs 2 and 3/C; selection only is shown*

SEAMAN
Bootsmanns-Laubbann
(Matrose)



ORDNANCE ENGINEER
Artillerie-Mechaniker



AIRCRAFT SPOTTERS
Flugmeldpersonal



MOTOR TRANSPORT
DRIVER
Kraftfahrer



NAVAL ARTILLERY
Marine Artillerie



STOREKEEPER
Verwalter



MINE MACHINIST
Speer-Mechaniker

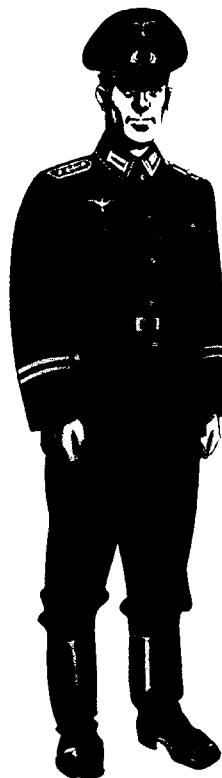


TORPEDOMAN
Torpedo-Mechaniker

GERMAN NAVY: FIELD GRAY UNIFORMS



FIELD GRAY UNIFORM, OFFICERS
Lieutenant (jg)
Leutnant zur See



FIELD GRAY UNIFORM, WOs, POs
Warrant Officer, Coast Artillery
Oberfeldwebel



FIELD GRAY UNIFORM, SEAMEN
Seaman, 2d Class
Gefreiter

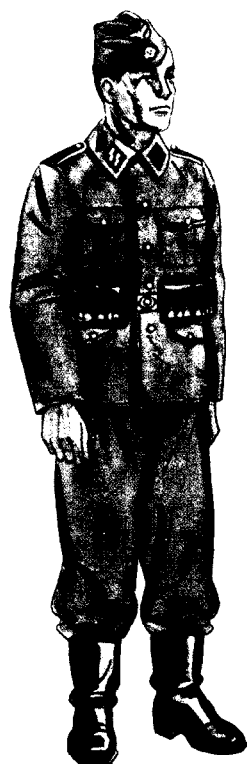
INSIGNIA OF RANK FOR FIELD GRAY UNIFORM: OFFICERS

COMMODORE OR CAPTAIN Kommodore oder Kapitän zur See	COMMANDER Fregattenkapitän	LT COMMANDER Korvettenkapitän	LIEUTENANT Kapitänleutnant	LIEUTENANT (jg) Oberleutnant zur See	ENSIGN Leutnant zur See

WARRANT OFFICERS, PETTY OFFICERS, AND SEAMEN OF NAVAL COAST ARTILLERY

CHIEF WARRANT OFFICER Stabsfeldwebel	WARRANT OFFICER Oberfeldwebel	CHIEF PETTY OFFICER Stabsfeldwebel	PETTY OFFICER 1/C Feldwebel	PETTY OFFICER 2/C Obermaat	PETTY OFFICER 3/C Maat
		COLLAR PATCHES FOR FIELD GRAY UNIFORM COATS →			
PETTY OFFICER ASPIRANT Unteroffizieranwärter	ENLISTED MAN BELOW PO GRADE			COMMISSIONED OFFICERS	WOs, POs, SEAMEN

ARMED ELITE GUARD (WAFFEN-SS) UNIFORMS



FIELD UNIFORM, EM

Most Waffen-SS troops wear Army coats, but some still wear the style of coat shown.



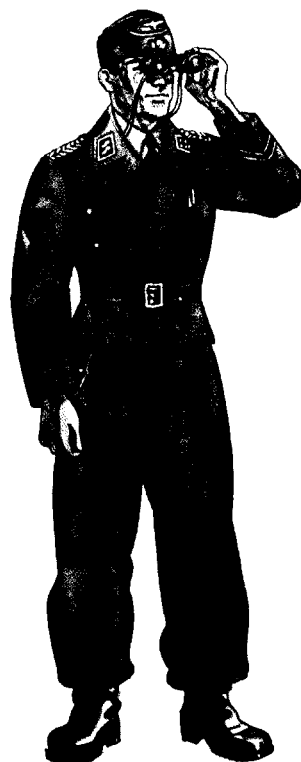
MOUNTAIN UNIFORM

The coat is the SS coat at left, which may be worn with collar turned down as above.



SP GUN CREW UNIFORM

In uniform, the SS coat is the field gray jacket uniform worn by certain Army troops.



TANK UNIFORM

This uniform is the same as the black uniform worn by certain troops in the Army.



TANK COVERALL

Tank crews of the Waffen-SS may also wear this camouflage non-reversible coverall.



CAMOUFLAGE JACKET

Some SS jackets have camouflage patterns, unlike Army jackets. No patches for cavalry.

ARMED ELITE GUARD (WAFFEN-SS) UNIFORMS



SERVICE DRESS, OFFICER
Waffen-SS officers may wear Army coats instead of the type of SS coat illustrated.



SERVICE DRESS, NCO
1st Sgt; the coat shown is the Army coat which must appear with pleatless pockets.



OVERCOAT, NCOs AND EM
Coat is the same as the Army overcoat. Note the absence of insignia.



OVERCOAT, GENERALS
Note the gray lapel facings. Other officers wear plain lapels on their overcoats.



CAMOUFLAGE SUIT
Waffen-SS regulations forbidding the wearing of insignia on this suit are ignored.





















WINTER UNIFORM
Some of the SS armored troops have been furnished with this special type of parka.

ARMED ELITE GUARD (WAFFEN-SS): COLORS OF THE ARMS











Waffen-SS troops wear collar patches similar to those of the General SS (*Allgemeine SS*), but Waffen-SS shoulder straps are after the German Army pattern, except for that of the *Reichsführer-SS*

 Light Brown CONCENTRATION CAMP GUARDS	 Gold Yellow CAVALRY AND MTZ RCN	 Burgundy Red JAGD
 Bright Red ARTILLERY	 Lemon Yellow SIGNAL AND PROPAGANDA TROOPS	 Dark Blue MEDICAL TROOPS
 Crimson VETERINARY CORPS	 Light Green MOUNTAIN INFANTRY	 Light Blue SUPPLY AND TECHNICAL SERVICES
 Pink TANK, ANTITANK TROOPS	 Grass Green RIFLE REGTS OF SS POLICE DIVS	 Sky Blue ADMINISTRATORS
 Salmon Pink MILITARY GEOLOGISTS	 Dark Green RESERVE OFFICERS	 Light Gray GENERAL OFFICERS
 Orange Red REPLACEMENT SERVICES, ENGINEERING OFFICERS	 White INFANTRY	 Black ENGINEERS







INSIGNIA OF RANK: GENERAL OFFICERS

  REICHSFÜHRER-SS Chief of Genl and Waffen-SS (Heinrich Himmler)	SS generals once wore collar patches with the fol- lowing insignia: General — 3 leaves, 2 pips Lt Gen — 3 leaves, 1 pip Maj Gen — 3 leaves Brig Gen — 2 leaves, 1 pip Police generals now wear the same collar patches as SS generals	  GENERAL <i>Generaloberst der</i> <i>Waffen-SS</i> (Oberstgruppenführer in Genl SS)	  LT GENERAL <i>General der Waffen-SS</i> (Obergruppenführer in Genl SS)	  MAJOR GENERAL <i>Generalleutnant der</i> <i>Waffen-SS</i> (Gruppenführer in Genl SS)	  BRIGADIER GENERAL <i>Generalmajor der</i> <i>Waffen-SS</i> (Brigadeführer in Genl SS)
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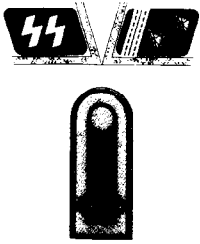
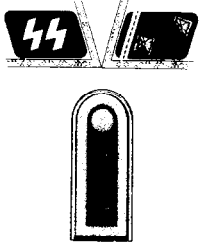
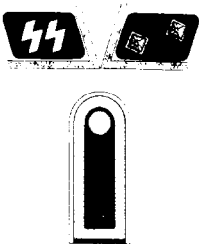
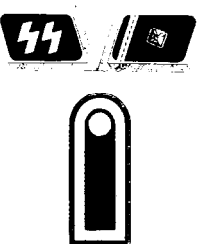
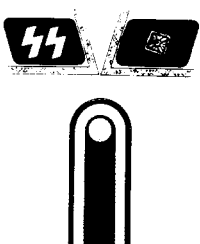
FIELD OFFICERS

  SENIOR COLONEL <i>Oberführer</i> Mountain Troops	  COLONEL <i>Standartenführer</i> Infantry	  LT COLONEL <i>Obersturmbannführer</i> Artillery	  MAJOR <i>Sturmbannführer</i> Engineers
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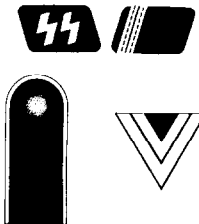
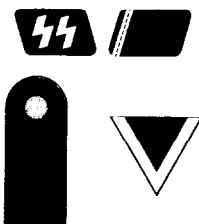
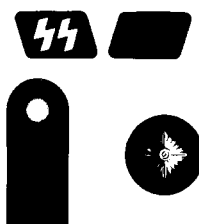
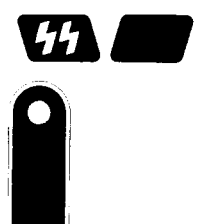
COMPANY OFFICERS

  CAPTAIN <i>Hauptsturmführer</i> Supply Troops	  1ST LIEUTENANT <i>Obersturmführer</i> Artillery	  2D LIEUTENANT <i>Untersturmführer</i> Infantry
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ARMED ELITE GUARD (WAFFEN-SS): INSIGNIA OF RANK—NONCOMMISSIONED OFFICERS

				
SEERGEANT MAJOR <i>Sturmcharführer</i> Artillery	1ST AND 2ND SERGEANT <i>Hauptcharführer</i> Cavalry	TECHNICAL SERGEANT <i>Oberscharführer</i> Infantry	STAFF SERGEANT <i>Scharführer</i> Artillery	SERGEANT <i>Unterscharführer</i> Artillery









INSIGNIA OF RANK: ENLISTED MEN

			
CORPORAL <i>Sturmmann</i> Infantry	ACTING CORPORAL <i>Sturmmann</i> Artillery	PRIVATE 1ST CLASS <i>SS-Oberschütze</i> or <i>SS-Obersoldat</i> Medical Troops	PRIVATE <i>SS-Schütze</i> or <i>SS-Soldat</i>

SPECIALTY BADGES—Worn on lower left arm by officers, NCOs, and men. See also Army sniper badges

					
SECURITY SERVICE <i>Sicherheitsdienst</i>	FARRIER PERSONNEL <i>Hufbeschlagpersonal</i>	TECHNICIAN OFFICERS <i>Führer im technischen Dienst</i>	SIGNAL PERSONNEL <i>Nachrichtenpersonal</i> (Blitz color changes with arm)	TRANSPORT SERGEANTS <i>Schirrmeister</i>	MEDICAL PERSONNEL <i>Sanitätspersonal</i>
					
ORDNANCE NCOs <i>Waffenunterführer</i>	VETERINARY OFFICERS, NCOs <i>Führer und Unterführer im Veterinärdienst</i>	OFFICERS IN LEGAL WORK <i>Führer im Gerichtsdienst</i>	MUSICIAN OFFICERS <i>Musikzugführer</i>	ADMINISTRATIVE OFFICERS <i>Führer im Verwaltungsdienst</i>	MEDICAL OFFICERS <i>Führer im Sanitätsdienst</i>

TYPICAL ARM BANDS

				
TOTENKNOPF DIV & UNITS	GERMANIA DIVISION	DAS REICH DIVISION		
				
NORD MOUNTAIN DIVISION	LIEBESTANDARTE ADOLPH HITLER DIV	PRINZ EUGEN MTN DIVISION	VETERANS OF SERVICE IN ARMED FORCES OR IN POLICE	NAZI PARTY MEMBERS PRIOR TO 30 JAN 1933 <i>Alter Kämpfer</i>

SPECIAL COLLAR PATCHES

		
BOSNIAN-CROATIAN MTN DIV	TOTENKNOPF DIV & UNITS	PRINZ EUGEN MTN DIV

The chevrons to indicate previous service in the armed forces or police (above) are worn on the upper right arm, and are not to be confused with chevrons to indicate rank, as worn on the upper left arm. The special collar patches at left are worn instead of the standard SS right collar patch.

GERMAN DECORATIONS AND AWARDS

UNCLASSIFIED



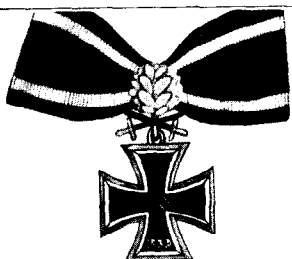
The above figures illustrate the manner of wearing some of the more common German decorations and awards. The officer at left wears two tank destruction badges; the one at right has Crimea shield on arm, assault and wound badges on breast, 1939 bar to 1914 Iron Cross in buttonhole, and the Knight's Cross on ribbon at neck.



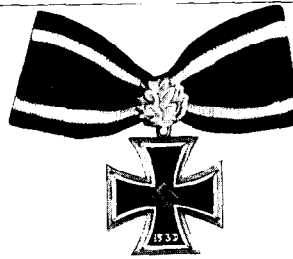
KNIGHT'S CROSS OF THE IRON CROSS
With gold oak leaves, swords, and diamonds



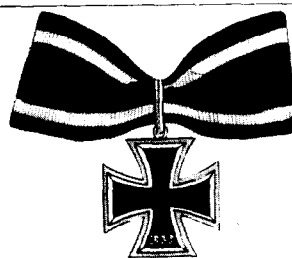
KNIGHT'S CROSS OF THE IRON CROSS
With oak leaves, swords, and diamonds



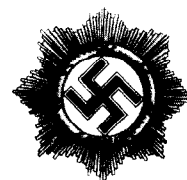
KNIGHT'S CROSS OF THE IRON CROSS
With oak leaves and swords



KNIGHT'S CROSS OF THE IRON CROSS
With oak leaves



KNIGHT'S CROSS OF THE IRON CROSS



THE GERMAN CROSS
Worn on sleeve



IRON CROSS 1ST CLASS
Worn without ribbon



IRON CROSS 2D CLASS
Usually ribbon only worn



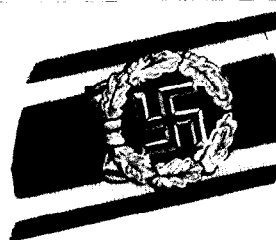
1939 BAR TO 1914 IRON CROSS
Worn in buttonhole



WAR SERVICE CROSS WITH SWORDS
Silver or bronze



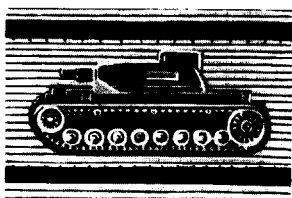
WAR SERVICE CROSS WITHOUT SWORDS
Silver or bronze



HONOR ROLL CLASP
Worn in buttonhole

GERMAN DECORATIONS AND AWARDS

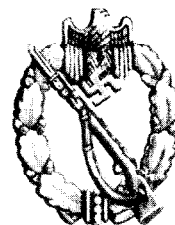
UNCLASSIFIED



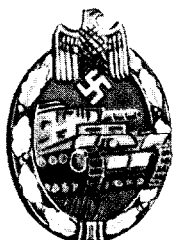
TANK DESTRUCTION BADGE
Gold for 5 tanks



WOUND BADGE
Gold, silver, and black



INFANTRY ASSAULT BADGE



TANK ASSAULT BADGE



GENERAL ASSAULT BADGE



CLOSE COMBAT BADGE
Gold, silver, and bronze



GUERRILLA WARFARE MEDAL
Gold, silver, and bronze



WINTER DEFENSIVE CAMPAIGN IN EAST,
1941-42



NARVIK SHIELD
Gold for the Navy



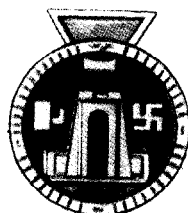
CHOLM SHIELD



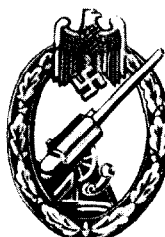
CRIMEA SHIELD



DEMJANSK SHIELD



GERMAN-ITALIAN MEDAL



ARMY ANTI-AIRCRAFT BADGE

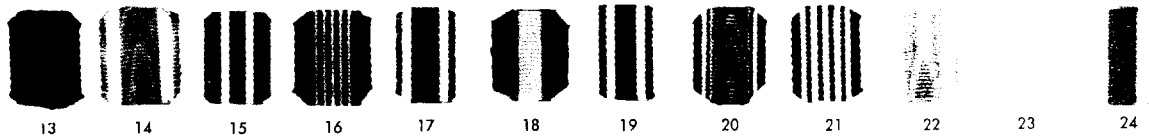


MOTOR VEHICLE DRIVER'S BADGE

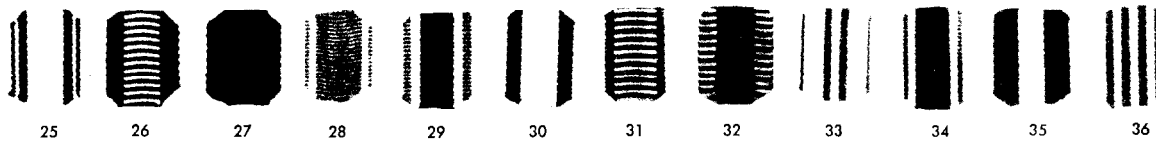
RIBBONS FOR VALOR AND SERVICE—These ribbons are a selection of those which may be worn above the left breast pocket by German military personnel.



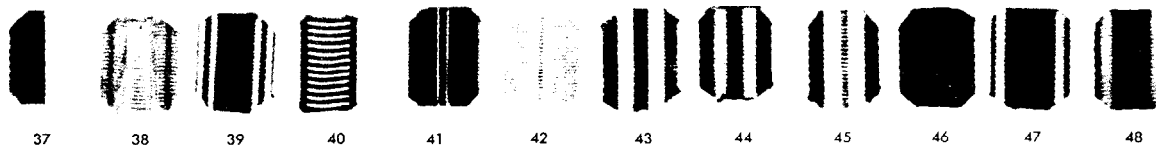
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|----------------------|--|--|
| 1. IRON CROSS, 1914 | 5. EASTERN WINTER CAMPAIGN, 1941-42 | 9. PARTY SERVICE BADGE (20 Years) |
| 2. IRON CROSS, 1939 | 6. WAR CROSS OF HONOR (Front Line Fighter) | 10. GERMAN SOCIAL SERVICE |
| 3. WAR SERVICE CROSS | 7. PARTY SERVICE BADGE (24 Years) | 11. MEDAL FOR LENGTH OF MILITARY SERVICE |
| 4. WAR SERVICE MEDAL | 8. PARTY SERVICE BADGE (15 Years) | 12. ENTRY INTO AUSTRIA |



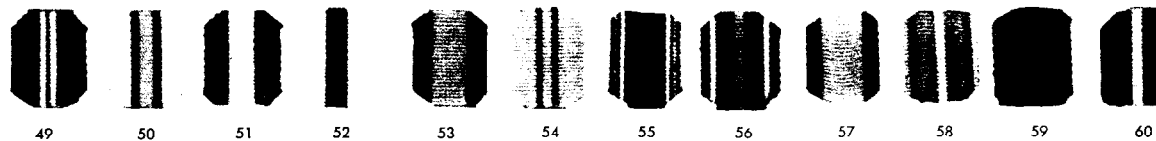
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| 13. ENTRY INTO SUDETENLAND | 17. GERMAN MOTHER'S CROSS | 21. PRUSSIAN WAR EFFORT CROSS |
| 14. WESTWALL SERVICE, 1939-40 | 18. FIREMAN'S RIBBON | 22. PRUSSIAN LIFE-SAVING MEDAL |
| 15. MEMEL RIBBON | 19. BALTIC CROSS (1919-20 Freikorps Service) | 23. SILESIAN EAGLE (1919-20 Fighting vs Poland) |
| 16. OLYMPIC GAMES MEDAL | 20. A.R.P. MEDAL | 24. BADEN MILITARY SERVICE CROSS |



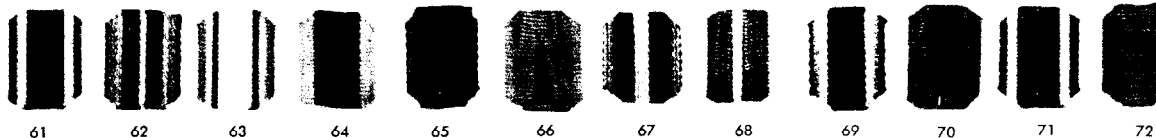
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| 25. BAVARIAN MILITARY SERVICE CROSS | 29. BAVARIAN MEDAL OF VALOR | 33. AUSTRIAN WAR SERVICE MEDAL |
| 26. KING LUDWIG CROSS | 30. WURTEMBERG MILITARY SERVICE CROSS | 34. TIROL SERVICE MEDAL |
| 27. PRINCE REGENT LUITPOLD MEDAL | 31. AUSTRIAN MEDAL OF VALOR | 35. HAMBURG HANSA WAR CROSS |
| 28. BAVARIAN MILITARY SERVICE BADGE | 32. KARL TROOP CROSS | 36. BREMEN HANSA WAR CROSS |



- | | | |
|------------------------------------|------------------------------|---------------------------------------|
| 37. LUBECK HANSA WAR CROSS | 41. CROATIAN MEDAL OF VALOR | 45. ITALIAN SERVICE MEDAL |
| 38. BULGARIAN MEDAL OF VALOR | 42. SLOVAKIAN MEDAL OF VALOR | 46. FINNISH SERVICE MEDAL |
| 39. BULGARIAN WAR SERVICE MEDAL | 43. AFRICA RIBBON | 47. FINNISH LIBERATION CROSS I CLASS |
| 40. HUNGARIAN WAR SERVICE (Horthy) | 44. ITALIAN MEDAL OF VALOR | 48. FINNISH LIBERATION CROSS II CLASS |



- | | | |
|--|------------------------------|---|
| 49. FINNISH LIBERATION CROSS III CLASS | 53. SPANISH CAMPAIGN MEDAL | 57. RUMANIAN MEDAL OF VALOR AND LOYALTY |
| 50. SPANISH MILITARY MEDAL OF VALOR | 54. SPANISH WOUND MEDAL | 58. RUMANIAN FAITHFUL SERVICE CROSS (Peace) |
| 51. SPANISH RED MILITARY SERVICE CROSS | 55. SPANISH SURVIVORS RIBBON | 59. RUMANIAN MEDAL OF VALOR |
| 52. SPANISH WHITE MILITARY SERVICE CROSS | 56. SPANISH COMMUNIST RIBBON | 60. RUMANIAN ORDER OF THE CROWN (Post 1932) |



- | | | |
|--|-------------------------------------|---------------------------------------|
| 61. RUMANIAN ORDER OF THE CROWN (Pre-1932) | 66. CROSS OF QUEEN MARIE OF RUMANIA | 70. BRONZE CROSS OF VALOR AND SERVICE |
| 62. RUMANIAN FAITHFUL SERVICE CROSS (War) | 67. RUMANIAN FLIERS' MEDAL OF VALOR | (For Eastern Volunteers) |
| 63. RUMANIAN MEDICAL SERVICE CROSS | 68. RUMANIAN FLIERS' ORDER OF VALOR | 71. SILVER CROSS OF VALOR AND SERVICE |
| 64. RUMANIAN FAITHFUL SERVICE MEDAL (War) | 69. STAR OF RUMANIA | (For Eastern Volunteers) |
| 65. RUMANIAN ANTI-COMMUNIST SERVICE | | 72. GOLD CROSS OF VALOR AND SERVICE |
| | | (For Eastern Volunteers) |

CHAPTER X

GERMAN AIR FORCE

Section I. AIR FORCE HIGH COMMAND

1. General

The German Air Force (*Luftwaffe*), one of the three branches of the German Armed Forces, is organized and administered independently of either the Army or the Navy. Its three main branches are the flying troops, antiaircraft artillery, and air signal troops. It also includes parachute and airborne troops, air engineers, air medical corps, and air police, and a number of special divisions formed of Air Force personnel for service as regular fighting troops. It is organized on a territorial rather than a functional basis, with separate operational and administrative commands. This division of responsibilities has made for a high degree of mobility among the flying units and thus has been responsible for much of the success of the German Air Force.

2. Commander-in-Chief

Reichsmarschall Goering serves in the dual capacity of Minister of Aviation (*Reichsminister der Luftfahrt*) and Commander-in-Chief of the Air Force (*Oberbefehlshaber der Luftwaffe*). As Commander-in-Chief he is charged with the administration and operations of the Air Force. As Minister of Aviation he is a member of the Cabinet and is responsible for the coordination and supervision of civil aviation. Since Goering has many other duties in the German Government, however, the supreme command usually is exercised by the State Secretary in the Ministry of Aviation and Inspector General of the Air Force.

3. Air Ministry (*Reichsluftfahrtministerium* or R.L.M.)

At the Air Ministry—the highest administrative and operational authority of the Air Force—are found the departments which control all Air Force activity. These departments fall into two groups:

those of the General Staff and those concerned with administration and supply.

Section II. CHAIN OF COMMAND

1. General

The role of the Air Force in the conduct of the war, and to a certain extent in particular operations, is determined by the High Command of the Armed Forces (*Oberkommando der Wehrmacht*). The chain of command is from the Supreme Commander (Hitler), through the OKW to the Commander-in-Chief of the Air Force (Goering). The latter directs the actual employment of the Air Force through the Air Ministry and through his subordinate commanders of air combat units. However, when Air Force units are used in conjunction with Army or Navy units, all the forces involved come under a single operational control, in accordance with the German doctrine of unity of command. In such circumstances, a commanding officer is chosen from whichever of the three branches predominates in the operation, and he becomes directly responsible to the OKW.

2. *Luftflotte*

All Air Force units are organized into tactical and territorial air commands known as *Luftflotten*. Each *Luftflotte* is assigned a particular command area, although this assignment is not necessarily permanent, for an entire *Luftflotte* at any time may be moved from one area to another at the direction of the Air Ministry. Within its area, however, each *Luftflotte* not only controls all operations of the flying units, but also supervises the activities of all ground service units. Thus, in addition to a large operations department, each *Luftflotte* has its own adjutant, legal, administration, signal, and supply departments. All com-

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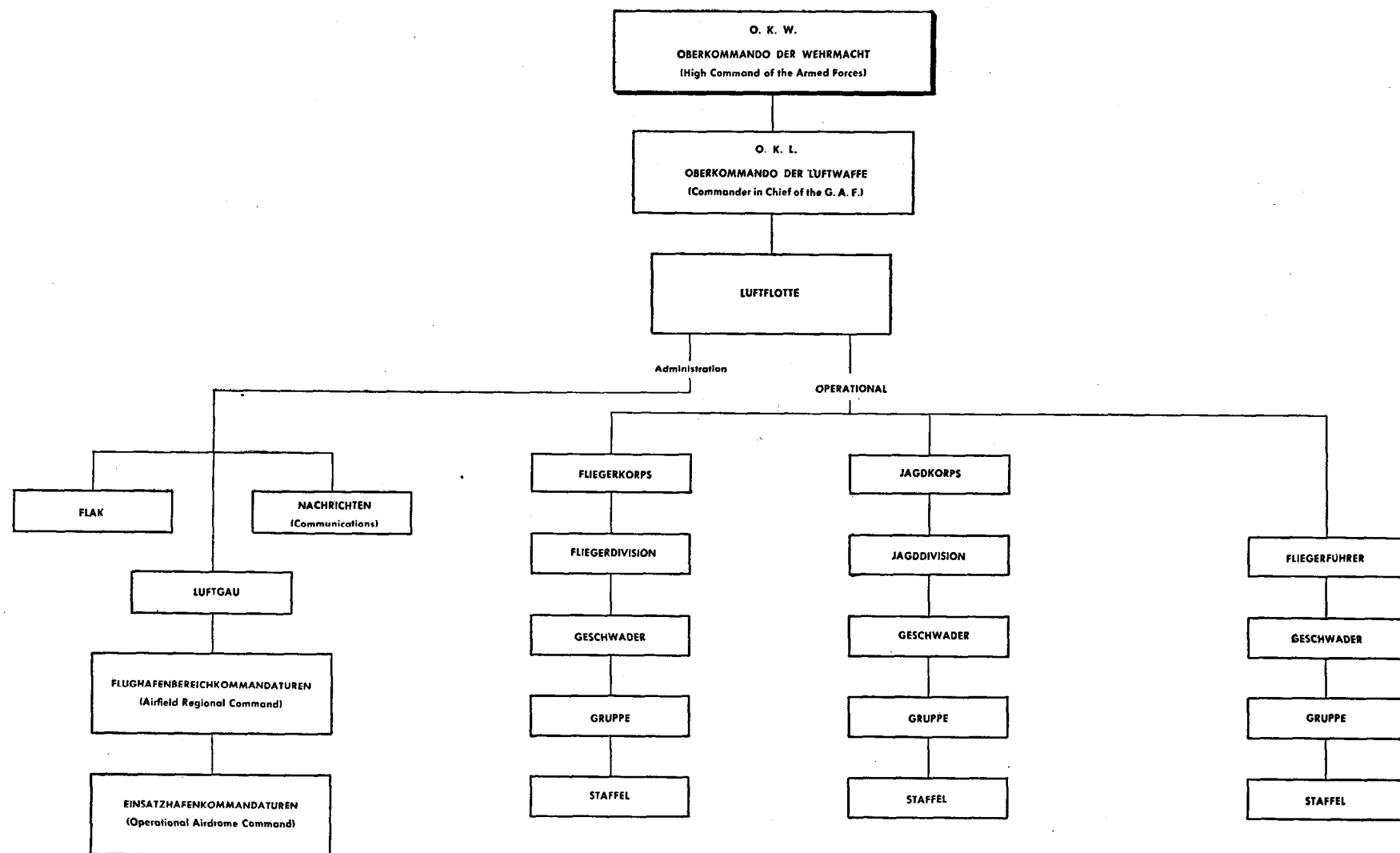


Figure 2.—German Air Force chain of command.

mands and formations subordinate to the *Luftflotte* are either essentially operational (*Fliegerkorps*, *Jagdkorps*, *Geschwader*, *Gruppen*, and *Staffeln*) or administrative (*Luftgaue*). Thus the administrative and operational commands meet at the *Luftflotte* headquarters, where their respective activities are coordinated.

3. *Fliegerkorps*

Operational units within the *Luftflotte* command area are organized into subordinate operational commands known as *Fliegerkorps*. Through these *Fliegerkorps*, the *Luftflotten* execute the operational directives received from the Air Ministry. Each *Fliegerkorps* is a composite, mobile command with its own geographical area of control and operations. A *Luftflotte* may command one or several *Fliegerkorps*, depending upon the size of the command area and the nature of operations. A *Fliegerkorps* may be detached at any time for operations in another *Luftflotte* area. The make-up of a *Fliegerkorps* is very elastic, both as to number and type of aircraft. It may consist of several bomber *Geschwader*, several fighter *Geschwader*, in addition to a varying number of short- and long-range reconnaissance *Gruppen*. On occasion it may be limited to one function such as that of a bomber command. The most important department of the *Fliegerkorps* command is that of operations. Although the *Fliegerkorps* also has adjutant, legal, administration, signal, and supply departments, it depends almost entirely upon the *Luftgau* for administrative and supply services. The *Fliegerkorps* are numbered nonconsecutively in Roman numerals.

4. *Jagdkorps*

A *Jagdkorps* is an operational command, similar to a *Fliegerkorps* but whose function is limited to that of a fighter command.

5. *Fliegerdivision*

A *Fliegerdivision* is an operational command similar to but of less importance than a *Fliegerkorps*. Most of the *Fliegerdivisionen* which existed prior to the war were replaced by *Fliegerkorps*. Several *Fliegerdivisionen* still exist on the Eastern Front.

6. *Jagddivision*

A *Jagddivision* is a command subordinate to a *Jagdkorps*.

7. *Lehrdivision*

This division is unnumbered and is known simply as the *Lehrdivision*. Its primary function was to test the latest types of aircraft, antiaircraft defenses, and air signals equipment from a tactical and operational point of view. *Lehr* units are incorporated directly into the combat commands and function as a part of the command's operational strength. *Lehr* personnel are supposed to have had previous combat experience. This system, by giving the *Lehr* units an operational status, enables them to experiment in actual combat operations, rather than under simulated conditions. The *Lehrdivision* was organized into a variety of formations and commands. There were two *Lehrgeschwader* composed of bomber, fighter, and reconnaissance *Lehrgruppen*. Recently, however, only a few bomber *Lehr* units have been operational and they no longer appear concerned with experimentation. There are also two *Lehrregimenter*, one concerned with antiaircraft defenses and the other with signal developments. *Lehr* units are not to be confused with experimental units whose duties are of a technical nature, such as the testing of prototype aircraft.

8. *Geschwader*

a. GENERAL. The *Geschwader* is the largest mobile, homogeneous formation in the Air Force, and is used for long-range bombers, ground attack units, and both single- and twin-engine fighters. It normally consists of about 100 aircraft, organized into three *Gruppen*. A fourth and, in a few instances, a fifth *Gruppe* have been added to several single-engine fighter *Geschwader*.¹ Apparently the original intention was to have each *Geschwader* operate as a unit by stationing all three *Gruppen* at adjacent airdromes. However, although all *Gruppen* are now usually found on the same battlefield, all three of them are unlikely to operate from neighboring fields. In fact, it is not uncommon at present for the Air Force to withdraw one or two *Gruppen* for rest or re-equipment and subsequently return them to operations in another theater.

b. COMMAND. A *Geschwader* is generally commanded by an *Oberst* or *Oberstleutnant* known as the *Geschwaderkommodore*. He has a small staff of officers for the adjutant, operations, or-

¹ These fourth and fifth *Gruppen* are not to be confused with the *Erganzungsggruppen*, which are devoted to operational training as discussed in Section VII.

ganization, technical, signal, navigation, meteorological, and intelligence branches. Some staffs also have a photographic officer. The staff has its own headquarters flight (*Stabs-Schwärm*) of three to six aircraft of the same type as those which make up the *Geschwader*. This *Geschwader* staff is always maintained, even when the subordinate *Gruppen* are separated for operations on different fronts.

c. TYPES. There are several types of *Geschwader*, known according to aircraft complement and/or operational employment as follows:

German title	Aircraft type	Abbreviation
<i>Kampfgeschwader</i>	Bomber	K. G.
<i>Schlachtgeschwader</i> ¹ ...	Ground attack and antitank ..	S. G.
<i>Jagdgeschwader</i>	Single-engine fighter	J. G.
<i>Zerstörergeschwader</i> ..	Twin-engine fighter	Z. G.
<i>Nachtjagdgeschwader</i> ..	Night fighter ...	N. J. G.
<i>Lehrgeschwader</i>	Tactical experimental	L. G.

Each *Geschwader* is designated by its abbreviation followed by an Arabic numeral: for example, K.G.77, N.J.G.26, Z.G.111, etc. The numerals are not necessarily in consecutive order.

d. EQUIPMENT. Although all *Gruppen* in a *Geschwader* specialize in similar air tactics and are equipped with the same type of plane, the make and model may differ among the *Gruppen*. This variation is most prevalent in fighter *Geschwader*, but also occurs in a few of the bomber *Geschwader*. Thus a *Kampfgeschwader* may have one *Gruppe* equipped with the Dornier 217 and the other two *Gruppen* with the Heinkel 111, Junkers 88, or the Focke-Wulf 200. Or the entire *Geschwader* may be equipped with the same make of plane, such as the Messerschmitt 109, although one *Gruppe* may have a newer model while the other *Gruppen* have earlier ones.

9. Gruppe

a. GENERAL. The *Gruppe* is the basic combat unit of the Air Force for both administrative and operational purposes. It is a mobile homogeneous unit which is largely self-contained and which may be detached from its parent *Geschwader* for operations in any command area. In fact, directives for the movement of flying units are almost

¹ *Sturzkampfgeschwader* (Dive bomber) and *Schnellkampfgeschwader* (Ground attack) have been incorporated into, or superseded by the *Schlachtgeschwadern*.

always issued in terms of *Gruppen*. Usually the entire *Gruppe* is based at the same airdrome.

b. COMMAND. The *Gruppe* normally is commanded by a major or captain known as the *Gruppenkommandeur*. He has a small staff, consisting of the adjutant, operations officer, technical officer, and medical officer. There apparently is no special intelligence officer, since prisoners are sent directly to interrogation centers. Each *Gruppe* also has its own air signal platoon (*Luftnachrichtenzug*), known as a Technical Ground Station, and a staff flight (*Stabs-Kette*) of three aircraft generally of the same type with which the *Gruppe* is equipped.

c. EQUIPMENT. The *Gruppen* are organized into three *Staffeln*, with the exception of single-engine fighter *Geschwadern* which recently have been organized into four *Staffeln*. Thus, most *Gruppen* are considered to have a table of organization of 27 aircraft each (exclusive of the three aircraft of the *Gruppen-Stab*) and *Jagdgruppen* a table of organization of 36 aircraft (also exclusive of the *Gruppen-Stab*). Actual strength, however, is likely to differ substantially from authorized strength; on many occasions it has been found well below or above such figures. *Gruppen* attached to a *Geschwader* are numbered in Roman numerals in consecutive order. Thus I/K.G.77, II/K.G.77, and III/K.G.77 are the first, second, and third *Gruppen*, respectively, of long-range bomber *Geschwader* 77.

10. Staffel

a. GENERAL. The *Staffel* is the smallest Air Force operational unit, and is generally commanded by a captain or lieutenant known as the *Staffelkapitän*. One officer serves as adjutant; the signal, technical, and navigation branches are supervised by the flying personnel in their spare time.

b. EQUIPMENT. A *Staffel* is considered to have a table of organization of nine aircraft. Its actual strength, however, may be as low as five or six aircraft or as much as 18 or 20 aircraft. For tactical purposes, it may be subdivided into *Schwärme* of five planes; into *Ketten* of three planes; or into *Rotten* of two planes. Each *Staffel* usually will have its own mobile repair shop for minor repairs in the dispersal areas; other motor vehicles must be drawn from the organization of the parent *Gruppe*.

c. NUMBERING. All *Staffeln* in the *Geschwader* are numbered consecutively in Arabic nu-

merals. Thus, in all but *Jagdgeschwader*, the first, second, and third *Staffeln* constitute *Gruppe I*; the fourth, fifth and sixth *Staffeln*, *Gruppe II*; and the seventh, eighth, and ninth *Staffeln*, *Gruppe III*. Where a fourth or fifth *Gruppe* exists, the *Staffeln* will be numbered 10, 11, and 12, or 13, 14, and 15, respectively. In *Jagdgeschwadern* having four *Staffeln*, the *Gruppe I* thus will contain *Staffeln* 1, 2, 3, and 4; *Gruppe II*, *Staffeln* 5, 6, 7, and 8; *Gruppe III*, *Staffeln* 9, 10, 11, and 12, etc. In unit designations, the *Gruppe* numeral is omitted whenever the *Staffel* number is indicated. Thus the fourth *Staffel* of K.G.77 is known as 4/K.G.77, and no other reference to its position in *Gruppe II* of K.G.77 is necessary.

11. Semiautonomous Units

a. GENERAL. Reconnaissance and Army cooperation aircraft operate and are organized as semiautonomous units, as *Staffeln* or *Gruppen*. These semiautonomous units fall into three general categories, all of which are numbered non-consecutively in Arabic numerals of one, two or three digits.

b. LONG-RANGE RECONNAISSANCE. Long-range reconnaissance aircraft are organized into *Fernaufklärungsgruppen*, which are known as (F) or FAG units. Thus 3(F)123 is the third *Staffel* of *Fernaufklärungsgruppe* 123.

c. SHORT-RANGE RECONNAISSANCE. Short-range reconnaissance and Army cooperation aircraft are organized into *Nahaufklärungsgruppen*, which are known as NAGr or (H) units (due to former name of *Heeresaufklärungsgruppen*). Under the old nomenclature still applying to some units, the first *Staffel* of *Nahaufklärungsgruppe* 32 is therefore 1(H)32. Under the more recent *Gruppen* organization and numbering, the third *Staffel* of *Nahaufklärungsgruppe* 1 for instance, is 3/NAGr 1.

d. COASTAL RECONNAISSANCE. Coastal reconnaissance and naval cooperation aircraft were originally organized into *Küstenfliegergruppen* (abbreviated K.F.Gr.). They are now known as *Seeaufklärungsgruppen* (abbreviated SAGr.). Thus the third *Staffel* of *Seeaufklärungsgruppe* 196 is known as 3/SAGr. 196.

e. MISCELLANEOUS UNITS. Miscellaneous units also are similarly organized and operated.

(1) *Nachtschlachtgruppen* (Night Harassing) represent the relatively recent grouping of previously loosely organized *Staffeln*. Most of them are equipped with obsolete aircraft, although

coincidentally with their reorganization in *Gruppen*, these units have been modernized to some extent. Though some units in the East still have such aircraft as Arado 66, GO145, HE50, etc., those in the West are equipped with modern JU87 and FW190. These *Nachtschlachtgruppen* are numbered in Arabic numbers and thus abbreviated—NS1, NS2, NS3, etc.

(2) The *Luftbeobachter Staffeln* (Air Observers).

(3) A number of specialized units such as mine-sweeping *Staffeln*, etc.

12. Special Commands

a. *Jagdführer*. Separate fighter commands known as *Jagdführer*, or more commonly as *Jafü*, have been established in each *Luftflotte* since the outbreak of war. At first a *Jafü* was concerned primarily with matters of policy and controlled operations only on specific occasions. Yet, for a period, the *Jafüs* in France and Germany appeared to have had an overriding authority in directing all defensive fighter operations. Lately, however, it is believed that their functions have become virtually administrative.

b. *Fliegerführer*. Highly specialized operations on certain fronts have been put under the control of special commanders known as *Fliegerführer*. These *Fliegerführer* control operations in a particular area only and are directly responsible to the *Luftflotte* commander in whose area they operate. For instance, the three *Fliegerführer* (3, 4, 5) in *Luftflotte* V, although primarily concerned with antishipping operations and weather reconnaissance, controlled all types of combat aircraft in their area of operations.

13. Luftgau

a. GENERAL. The *Luftgaue* are the actual administrative and supply organizations of the *Luftwaffe*. They are stationary or immobile commands whose authority is limited to certain well defined and permanently fixed geographical areas. A *Luftgau* commander is usually a *General der Flieger* or *General der Flakartillerie*, and theoretically is responsible to the *Luftflotte* commander within whose command area the *Luftgau* lies. In actual practice, however, the *Luftgau* commanders receive most of their instructions direct from the Air Ministry, and the *Luftflottenchefs* interfere little with *Luftgau* administration. The *Luftgaue* permanently established in Germany are numbered non-consecutively by Roman numerals;

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those in occupied countries are generally designated by their location: for example, *Luftgau Norwegen*.

b. FUNCTIONS. Each *Luftgau* is responsible for the following services within its command area:

- (1) Administration, supply, and maintenance of all flying units.
- (2) Active and passive defense against air attack.
- (3) Operations of signal units.
- (4) All training other than that of auxiliary units.
- (5) Recruitment, mobilization, and training of reserve personnel.

c. SECTIONS. Each *Luftgau* has its own operations, adjutant, legal, administration, signal, and supply sections. It also has a department for prohibited and restricted flying areas which has no known counterpart in the *Luftflotte* or *Fliegerkorps* headquarters. All training within the *Luftgau* area is directed by a Higher Commander of Training. This officer is usually a *Generalmajor* and is subordinate only to the *Luftgau* commander. All other *Luftgau* services are maintained through subordinate section commands which are designated by Arabic numerals preceding the *Luftgau* unit designation. Thus 4/VIII is the fourth section command in *Luftgau VIII*.

d. AIRDROME COMMANDS. The main channels through which the flying units draw on the services of the *Luftgaue* are the airdrome commands. Each *Luftgau* area is divided into about five airdrome regional commands (*Flughafenbereichkommandanturen*). The regional commands are in turn subdivided into five or more operational airdrome commands (*Einsatzhafenkommandanturen*). The regional command is essentially administrative and is not necessarily located at an airfield. The operational airdrome command, however, exists only to serve the flying units at their stations and is thus always found at an airdrome. The manner in which the *Luftgau* has decentralized its authority through these commands is as follows:

- (1) The airdrome regional commands are charged with the *Luftgau's* responsibility for supply and maintenance of supplies and equipment within their respective areas; meeting the physical needs of the flying units; defense of aircraft, equipment, and motor transport against air attack; airdrome development; and air movements. These duties are discharged by specialized units

which the *Luftgau* allots to the regional command and which the regional command then redistributes among the operational commands. For example, the Field Works Office (*Feldbauamt*) at the regional command handles airdrome maintenance through its subsidiary Works Superintendent's Offices which are stationed at the airdromes. Similarly, the Air Signal Company at each regional command is divided into platoons which are stationed at the operational commands. A senior technical officer supervises aircraft maintenance in the region through his subordinate technical officers at the operational commands. The airdrome regional command is thus largely self-contained and calls on the *Luftgau* for assistance only when the units already assigned prove inadequate.

- (2) The airdrome regional command also acts as the intermediary between the *Luftgau* headquarters and the operational airdrome command. All orders, requests, reports, etc., traveling between the two must pass through the regional command staff. This staff numbers from 50 to 150 officers and enlisted men and is headed by a commandant who usually holds the rank of *Generalmajor*.

(3) The airdrome regional command's primary practical task is that of transporting supplies and equipment from the depots to its subordinate operational commands. For this purpose it is generally assigned a supply company (*Nachschubkompanie*) composed of a supply column staff (*Nachschubkolonnenstab*), some four transport columns (*Transportkolonnen*), and two or three fuel columns (*Flugbetriebsstoffkolonnen*).

- (4) The commander of the operational airdrome command normally holds the rank of major, captain, or first lieutenant. His adjutant handles personnel matters. The personnel complement of an operational command numbers about 350 officers and enlisted men, and the motor transport allotment is between 50 and 100 vehicles.

(5) Airdrome maintenance at each operational command is handled by a Works Superintendent's Office (*Bauleitung*), subordinate to the Field Works Office at the regional command. The *Bauleitung* has charge of most of the construction done at the airdrome (buildings, dispersal areas, defense works, camouflage, etc.), as well as the laying of runways, extension of landing grounds, and installation of lighting systems. Reports on serviceability and bomb damage are radioed through the regional command to the *Luftgau*, and thence to the Air Ministry for broadcast over

the Air Force Safety Service network. The *Bauleitung* personnel is composed of civil servants and technical staffs. Any other specialized construction units which may be attached to the airdromes to repair bomb damage or enlarge facilities are also directed by the *Bauleitung*.

(6) The operational airdrome command is also responsible for defense against air attack, for which it has both heavy and light *Flak* units. These guns and other aerial defense units are commanded by the airdrome commander only when there is no flying unit stationed at the field. Otherwise, defense is controlled by the commander of that flying unit which is occupying the airdrome.

(7) The telephone, teleprinter, and radio at each operational airdrome command are operated by an air signal platoon (*Fliegerhorst-Luftnachrichtenzug*) and commanded by a signal officer who is subordinate to the senior signal officer at the airdrome regional command. The signal platoon also transmits the meteorological and airdrome serviceability reports and operates the Air Movements Control. This control directs only nonoperational flying. Signal communications with aircraft in operations are controlled by the tactical ground station attached to the flying unit.

(8) Aircraft maintenance at the operational airdrome command—except for servicing and minor repairs which are performed by the ground staff of the flying unit—is the responsibility of a technical officer. This officer not only handles overhauls and major repairs, but also is responsible for maintenance of motor vehicles; for bomb, fuel, and other supply stores; and for equipment stores and the armory. He is subordinate to the senior technical officer at the airdrome regional command.

(9) The requests by the operational airdrome command for equipment and spare parts reach the regional command through the technical officer. Requisitions for bombs, fuel, and ammunition are made by the supply section. The operational command also has an administrative section which handles clothing, food, pay, billeting, and other accommodations; a record office; a photographic section; a medical section; and a welfare section.

(10) *Luftgaustäbe z.b.V.* During campaigns the *Luftgaue* provide the advancing air formation with supplies and services through a system of subordinate commands known as *Luftgaustäbe zur besonderer Verwendung* (*Luftgau*

staffs for special duty) or, simply, *Luftgaustäbe z. b. V.* units. These units may be designated by an Arabic numeral (*Luftgaustüb z. b. V. 3*) or by their location (*Luftgaustüb Kiev*). They are sent into the forward battle areas by their controlling *Luftgau* and are normally responsible for all services in an area occupied by a *Fliegerkorps*. After conditions have become relatively stabilized—for example, when operational airdrome commands have been established and supply stations and fuel and ammunition field depots have been set up—the *Luftgaustüb z. b. V.* unit is withdrawn and the parent *Luftgau* assumes direct command.

Section III. AIR FORCE ARMS AND SERVICES

I. Antiaircraft Defenses

a. GENERAL. The bulk of the German anti-aircraft artillery, inclusive of anti-aircraft searchlight units, is an organic part of the German Air Force. The German Army has anti-aircraft artillery units of its own, but these units are only for the organic use and protection of the Army units against air attack.

For organizational charts of *Luftwaffe* and Army anti-aircraft units see Sections V and VI, Chapter II. For a discussion of anti-aircraft weapons and equipment see Chapter VII, Section IV.

b. ANTI-AIRCRAFT DEFENSE OF GERMANY AND REAR AREAS. The Chief of the German Air Force is responsible for the air defense of territorial Germany as well as important installations in occupied countries. The Aircraft Warning Service as a part of the Air Force is tied in with the coordinated use of aviation, anti-aircraft artillery, and barrage balloons. All air raid precaution measures also are the responsibility of the Chief of the German Air Force.

Antiaircraft defense of rear areas is carried out through the *Luftgaue* mentioned above. *Luftgaue* coordinate their defenses with each other in accordance with regulations published by the Chief of the Air Force. The commander of each *Luftgau* has a specialist under him who exercises command over the anti-aircraft artillery units, including searchlights, assigned to the district. Other specialists include the commanders of barrage balloon units and of units responsible for carrying out special defense measures. In actual

operations, in most cases the commands above the actual operating units act mainly in a coordinating capacity, feeding information to the operating units which act in turn on their own initiative in accordance with prescribed standing operating procedure.

Within certain of the air districts there are special air defense commands. Each of these covers special areas or cities of vital importance, defense of which, under one command, is laid out with a concentration of coordinated defense facilities inclusive of antiaircraft guns and searchlights, fighter aviation, barrage balloons, warning facilities, and the use of special devices such as smoke generators.

Operation of the antiaircraft defense system calls for close cooperation between fighter planes and air warning systems, and the antiaircraft guns with supporting searchlights are considered the backbone of the static defense. For operational control, the antiaircraft command in a *Luftgau* is usually divided into groups known as *Flakgruppen*, and these groups in turn are divided into sub-groups known as *Flakuntergruppen*. The headquarters of the group is normally the control center of the *Flak* defenses, and acts downward through the sub-groups.

In deployment of heavy antiaircraft guns in important static areas, there is a tendency toward the use of concentrated sites known as *Grossbatterien*. These usually consist of three 4-, 6-, or even 8-gun batteries grouped together at one site, with fire control for all guns emanating from one central source.

Antiaircraft searchlights are used in cooperation with night fighters, as well as in their normal role of illuminating targets for the gun units.

c. USE OF ANTI-AIRCRAFT WITH FIELD FORCES. For operation in the field, *Luftwaffe* antiaircraft units are allotted to field task forces for protection of Army and Air Force installations. Even in moving situations, a certain amount of antiaircraft is present for the defense of important semi-permanent installations such as depots, parks, railroads, bridges, and airdromes. No hard and fast rule is laid down for this use of antiaircraft artillery. The size of the antiaircraft force defending such areas will depend to a large extent on importance of the areas to be defended, plus availability of *Luftwaffe* antiaircraft units for such assignment. *Luftwaffe* antiaircraft organizations and units operating with the Army are subordinated operationally and for command pur-

poses to the Army unit concerned, and administratively (for replacements, etc.) to their parent Air Force Organization.

Employment and composition of the higher *Flak* units will vary in accordance with local conditions. For a fuller discussion of the organization and employment of higher antiaircraft units in the field, see Section V, Chapter II.

d. DEFENSE OF RAILWAY TRAINS. The mounting of antiaircraft materiel on railway mounts for the protection of railway trains and as a means of furnishing a highly mobile defense of lines of communication has been highly perfected by the Germans. Antiaircraft guns on railway mounts can be used either in rear areas for protection of trains operating there, or for the protection of trains carrying troops or supplies to forward combat areas. Although the 20-mm single- or four-barreled *Flak* is normally employed for this purpose, the 37-mm, 88-mm and 105-mm guns will also be encountered mounted on railway cars.

2. German Air Force Signal Service (*Luftnachrichtenwesen*)

a. GENERAL. The importance of a comprehensive and efficient air signal service in aerial warfare is obvious. Neither offensive nor defensive air operations could be conducted without a complete network of signal communications, or without radio and radar equipment for the direction and control of aircraft, particularly in fighter defense. So vital is the role of the German Air Force Signal Service that it has had a greater proportionate wartime expansion than any other arm of the German Air Force, and now has an estimated personnel strength of between 175,000 and 200,000.

b. FLEXIBILITY. The efficiency of the German Air Force has been enhanced by the flexibility of its signal organization. This was particularly true when the Germans were advancing into new territory, usually well prepared, on a temporary basis, for the reception of flying units. As soon as the captured territory was firmly occupied, signal units then established a more permanent land-line communications system. Under present circumstances, with the Germans on the defensive, the flexibility and mobility of the German Air Force are no longer dependent to the same extent on its signal organization. However, a workable German Air Force Signal Service is still of paramount importance in the defense of Germany against air attacks.

c. **FUNCTIONS.** These include the transmission of all orders and communications necessary for the operation and functioning of the German Air Force, if possible both by landline and by wireless; the establishment and supervision of all navigational aids to aircraft; the manning of Observer Corps and radar in connection with air defense; control of air traffic, air safety and rescue services; and the interception of enemy signals.

d. **ORGANIZATION.** (1) *General.* One of the departments of the German Air Ministry is the Director General of Signal Communications (*Generalmachrichtenführer der Luftwaffe*). To handle its multiple duties, a flexible organization has been developed, consisting of many self-contained specialist companies. The bulk of these companies are allocated to the major operational and administrative commands, and the others are grouped into battalions or remain as individual companies attached to minor commands.

(2) *Section platoon and company.* The basic operational unit is the section (*Truppe*) of 10-20 men. Each section specializes in one particular signal activity such as telephone, teletype, cable laying, construction, etc. Five to ten sections of the same type are organized into a platoon (*Zug*) of 80 to 100 men. Three to six platoons are grouped into a company (*Kompanie*) of 200 to 300 men. All platoons in a company specialize in the same branch of signal activity, so that each company is a self-contained specialist unit.

(3) *Battalion and regiment.* Three to four companies usually make up a battalion (*Abteilung*), although some have many more. The strength of a battalion, aside from its staff, depends on the number of companies. Three to five battalions normally form a regiment (*Regimenter*), with a strength between 1,500 and 9,000 and varying functions.

(4) *Allotment and numbering of units.* Signal regiments and smaller units are allotted to the several different types of operational and administrative commands requiring a permanent allocation of signal personnel. Allocation is on the basis of the size and requirements of the command. The relationship of the signal units to their assigned commands often is indicated by the terminal number of the unit designation; e.g. *Luftflotte 2* had Signal Regiments 2, 12, and 22. However, with the creation of many new commands and the renumbering of others, the numbering

system for signal units is not as readily workable as formerly.

(5) *Special units.* In addition to the standard units, there is a special Research Regiment charged with the development of new types of signal equipment and its employment. Aircraft specially equipped for signal activities have also in many instances been allotted to various commands and have proved extremely useful in conducting air operations in mobile situations.

(6) *Command.* The supreme signal command of the above units is exercised by the Director General of Signals of the Air Ministry. Signal command of a *Luftflotte* is under a Chief Signal Officer (*Höhere Nachrichtenführer* or *Höhere Nafü*) who controls the senior Signal Officer (*Nafü*) of the *Fliegerkorps*, *Luftgau*, *Flak-Korps* and *Flak Division*, and *Airfield Regional Command*. Subordinate to these are the Signal Officers (*Nachrichten Offizier* or *N. O.*) who exercise command in the lower subdivisions such as Operational Airfield Command signal platoons, and *Geschwader* signal companies.

e. **SIGNAL EQUIPMENT.** (1) *General.* German signal equipment, generally speaking, has been characterized by standardization of design, relatively few major types, and a high quality of components and workmanship. During the first years of the war, the Germans did not fully appreciate the tactical possibilities of radar¹ and for a time Allied radar development was well ahead of the German. However, the Germans have made tremendous efforts to match Allied technical progress and to overcome the various tactical problems resulting from Allied superiority.

(2) *Ground radar.* German ground radar falls into three general categories: Early warning set (*Freya*, *Mammut* or *Wassermann*) for long range detection; *Giant Würzburg* primarily for aircraft interception control; and *Small Würzburg* designed for flak control, but also used for height finding in the Aircraft Reporting Service. These various types of ground radar equipment play a large part in the German system of air raid warning and control of fighter interception. Many devices have been developed by the Allies to nullify the effectiveness of the German equipment, but at the same time the Germans have

¹ The basic principle of radar is the transmission of a wireless pulse of very short duration, the reflection of the pulse by the object to be detected, and the reception of both the original and reflected pulses by a receiver adjacent to the transmitter. Electrical measurement of the time interval between the two pulses gives a direct indication of the distance of the reflecting object. Means are also provided whereby direction of the object from the transmitter, and in some cases its height, can be obtained.

developed numerous countermeasures. These measures and countermeasures have led to extremely rapid development of new techniques and equipment both by the Germans and by the Allies.

(3) *Airborne radio and radar.* German airborne radio and radar equipment may be classified in four general categories: *Funkgerat (FuG)*, or radio and radar equipment involving transmitters and receivers; *Peilgerat (PeG)*, or navigational equipment; *Notsender (NS)*, or emergency transmitter; and other types of miscellaneous equipment. Airborne equipment is an absolute necessity for the successful conduct of air operations. Throughout the war, the Germans have developed navigational, bombing, and fighter control equipment. The latter is particularly important at the present time for the Germans who must depend on adequate warning of Allied air attacks and efficient control of fighters and flak for effective opposition.

f. FIGHTER DEFENSE. (1) *General.* During 1941 and early 1942, the German Air Force fighter organization was concerned mainly with defense of targets in Northern France and the Lowlands. The bulk of aerial combats then were taking place in the relatively small area over those countries and over the English Channel; and a warning system, consisting of a coastal radar belt and visual observers, was adequate. But the greater depth of penetration by Allied bombers in 1943 required that the German Air Force protect targets in Germany as well as in occupied territory, and the defensive problem thus became infinitely more complex. Additional radar belts and observer posts were required. German fighters had to be placed in tactically favorable positions, and they were forced to enlarge the scope of their activity to cover all areas subject to attack. Such developments naturally led to considerable changes in the German Air Force fighter organization and the methods of fighter control. The liberation of France and part of the Lowlands in 1944 further complicated the German defensive problem by depriving the German Air Force of a large and efficient part of its early warning system, as well as many excellent airfields at a time when the weight of the Allied air assault was increasing.

(2) *Reporting and warning system.* The Aircraft Reporting Service is a part of the German Air Force. Long-range radar sets determine the range and bearing of the approaching aircraft,

and short-range sets measure height. Other types of equipment distinguish between friendly and hostile aircraft. An Observer Corps network with strategically located posts also supplies aircraft warning information, while in some instances patrolling aircraft shadow the attacking aircraft. On the basis of the information from these various sources, hostile aircraft are plotted in a central headquarters, and the Germans in the past have been able to construct a fairly accurate and current picture of Allied air operations. Proper warning then is given to all interested agencies, and defensive fighters are put in the air to intercept the attackers. Information on the course and expected target of the bombers is passed by radio to the airborne fighters until contact is made. The specific aerial tactics used by the German fighters have varied considerably throughout the war, but in general the precise method becomes the responsibility of the fighter pilots after contact is made. In spite of the excellent equipment and control methods the Germans have developed, their defensive warnings and operations are considerably handicapped by the loss of territory in Western Europe.

3. Airborne Forces

See Chapter X, section VII.

4. Air Force Fighting Units

See Chapter II, sections V, VI.

5. Air Transport

a. *GENERAL.* German transport aircraft and gliders are controlled by a General Staff Department at the Air Ministry. This department, headed by a *Kommodor und Lufttransportführer*, allocates and administers all transport units in the Air Force. The majority of the transport planes consist of the JU 52. This old type has been retained because of its adaptability to varied tasks and its ability to operate under difficult conditions. Since the production of JU 52's has been inadequate to meet present transport needs, the German Air Force has drawn upon Italian aircraft, such as the SM 82. Production of new types specifically designed as transports, such as the JU 252, JU 290 and the ME 323, has been almost negligible. The HE 111 has been adapted to extensive employment as a freight carrier, and lighter planes, such as the Fieseler Storch (FI 156), frequently are used for passenger-carrying

and liaison work. Transport and communications aircraft are organized for the following services:

b. FOR OPERATIONAL UNITS. The Air Force maintains several minor air transport units which are more or less permanently allocated to various commands. These units are not intended to perform any particularly heavy or large-scale transport work such as airborne operations or long-term supply. They are used rather for the numerous odd jobs of communications, liaison, and passenger-carrying within the *Luftflotte* area, or between the *Luftflotte* and Air Force headquarters in Germany. These units are distributed among the commands as follows:

(1) The staff of each *Luftflotte* and *Fliegerkorps* is allotted a transport *Staffel*, with 12 or 13 aircraft to be used for transport within Germany proper as well as in forward areas.

(2) Each *Fliegerkorps* is allotted a transport *Staffel* of 10 to 15 JU 52's in addition to a *Kurier-Staffel* (communications) of lighter planes. The *Fliegerkorps* then may temporarily re-allot part or all of the JU 52's to the subordinate *Geschwader* and *Gruppen* whenever the transport of personnel, equipment, and/or supplies becomes particularly urgent.

(3) Each operational *Gruppe* is allotted several lighter types of communication aircraft. Formerly, each *Gruppe* also had at least one JU 52 for transport purposes. Now, however, the *Gruppen* usually rely on JU 52's temporarily lent to them by the *Fliegerkorps* headquarters.

(4) Each *Aufklärungsgruppe* (reconnaissance group) has a *Kurier-Staffel* within the *Fliegerkorps* organization which is primarily intended for liaison with Army commanders. These aircraft are at the disposal of Army personnel as well as the Air Force reconnaissance officers.

(5) Allotted to each *Fliegerkorps* is a *Verbindungs-Staffel* (liaison) of communication aircraft which is used for contact work between Army headquarters and those Air Force units which are providing close or direct support for the Army.

(6) The main air signal regiments of each *Luftflotte* and *Fliegerkorps* have their own *Staffeln* or transport aircraft. Some of these planes are equipped as flying signal stations, but many are used simply for transporting equipment and personnel.

(7) The higher commands, including the *Oberkommando der Wehrmacht*, the *Oberkommando des Heeres*, the *Oberkommando der Marine*, and the *Oberkommando der Luftwaffe*, each have

their own *Kurier-Staffel* to carry mail and personnel. These aircraft operate on a fixed schedule over all of Germany and remaining occupied territory. Individual aircraft may also be detailed on special urgent tasks.

c. FOR CIVIL AIRLINES. A small number of transports, primarily JU 52's, still are used on those civil air routes which the *Deutsche Luft-hansa A. G.* operated before the war and continues to maintain under strict military supervision for high priority communication.

d. FOR K. G. z. b. V. UNITS. The *Kampfgeschwader zur besonderer Verwendung* (for special duty), known more simply as K. G. z. b. V. units, include over two-thirds of the German transport aircraft and are actually the mainstay of the Air Force transport organization. For limited operations these aircraft still may be subordinated to and receive their directives from the *Luftflotten* and *Geschwader*. In the past they occasionally were allotted by the Air Ministry to the *Luftflotten* on a fairly permanent basis (for example, to a *Luftflotte* headquarters). Now, however, they usually are so allotted for a specific operation only (for example, an airborne operation or supply mission). If only one or two units are allotted to a *Luftflotte*, the chief quartermaster department of the *Luftflotte* will handle administration, personnel, and aircraft serviceability. If several units are operating under the *Luftflotte*, however, the Air Ministry usually will detail an air transport officer to the *Luftflotte*. This officer, who normally holds the rank of *Oberst*, generally is assisted by a staff, which may include a technical officer, a personnel officer or adjutant, and an operations officer, in addition to a transport officer who apportions the loads.

The organization of the K. G. z. b. V. units is extremely fluid, and although the original intention apparently was to set up the units in *Geschwader*, the actual strength of most z. b. V. units rarely exceeds that of a *Gruppe*. These *Gruppen* normally number 53 aircraft organized into four *Staffeln* of 12 aircraft each plus a *Gruppenstab* of five planes.

For purposes of transporting parachute troops and air-landing infantry in airborne operations, transport aircraft are organized into z. b. V. *Geschwader*. Each such *Geschwader* consists of about 200 aircraft organized into four *Gruppen* of four *Staffeln* each. Each *Staffel* has 12 aircraft organized into four *Ketten* of three aircraft

each. The organization of the *Kampfgeschwader* thus closely parallels that of the parachute troops which they transport. A JU 52 can carry 10 to 12 fully equipped parachutists. Thus one section of parachutists is carried by one aircraft; a platoon of 36 men is carried by a *z. b. V. Kette*; a company of 120 to 144 men is carried by a *z. b. V. Staffel*; and an entire parachute battalion is carried by a *z. b. V. Gruppe*. Whenever possible, the men are moved by units, that is, a *z. b. V. Kette* carrying a parachute platoon.

e. SPECIALLY EQUIPPED TRANSPORTS. A number of JU 52's have been designed for highly specialized transport services. For example, many JU 52's, a number of which are attached to Air Force medical units, are fitted as ambulance planes with a capacity of 12 stretcher patients and five sitting patients. Some JU 52's temporarily have been equipped with skis, and others with pontoons for transporting men and supplies into areas made inaccessible by snow or separated by bodies of water.

f. GLIDERS. The Germans also are using towed gliders for air transport. Since they combine a high load capacity with comparatively small fuel consumption for the towing aircraft (or of the glider itself in the powered version), they first were used in the Lowlands in 1940. The DFS 230 and the Gotha 242 carried troops and supplies from Italy and Sicily to Africa from mid-1941 until the conclusion of the Tunisian campaign. In the fall of 1942, the ME 323 powered glider caused wide comment in its operations between Sicily and Tunisia. At the same time it was revealed that each dive-bomber *Staffel* operating from Tunisia had its own DFS 230 to carry supplies from Sicily to Africa. Critical supply situations on the Russian Front and in the Balkans forced the Germans to employ gliders in many instances. Though they have seen little service in the West to date, disruption of transportation lines through Allied aerial attacks may compel further use of unpowered gliders.

6. Sea Rescue Service

The Air Force Sea Rescue Service (*Seenotdienst*) was first established to take care of airmen shot down over the North Sea area and the English Channel. Its services were extended to the Mediterranean, the Black Sea, and the Baltic. Rescues are performed normally by the service's own aircraft, but where the hazards of water landing are too great, the actual rescue is made

by surface craft. These craft may be attached to the service or may be simply lent to it for a particular rescue.

Seenotdienst units were subordinated to the *Luftflotte* within whose area they serve. These units were organized into three sea rescue commands (*Seenotflugkommandos*), each of which is headed by a *Seenotdienstführer* with the rank of colonel. Subordinate to these commands are regional commands, known as *Bereichkommandos*, which control the various *Staffeln* and detachments. Single rescue planes were often attached to combat units which operated over water.

7. Meteorological Services

a. GENERAL. The Air Force Meteorological Service (*Flugwetterdienst*) is controlled by the Air Ministry. The chief responsibility of the *Flugwetterdienst* is to provide all flying units with dependable weather forecasts as well as all long-term forecasts for strategical planning. The two main sources of Air Force meteorological information are weather stations and weather aircraft.

b. WEATHER STATIONS. At each airfield there is a relatively small *Wetterstelle* (weather station) which reports on conditions in its immediate vicinity. These reports are collected at regular intervals (usually hourly) by a *Wetterberatungszentral* (weather reporting center) which then coordinates the reports of all the *Wetterstellen* within its area and prepares maps for the flying units. A center usually serves an area covered by a *Fliegerkorps* and frequently is motorized. Some centers carry a *Luftgau* unit designation, such as *W. Z. B./XIII*. The chain of command from the airfield to Air Ministry is completed through meteorological officers stationed at *Luftgau*, *Fliegerkorps*, and *Luftflotte* headquarters.

c. WEATHER AIRCRAFT. Attached to each *Luftflotte* is a *Wetterkündigungstaffel* (weather reconnaissance squadron), commonly known as a *Westa* unit. These units normally have nine to 12 aircraft equipped with automatic recording instruments. The crews include a meteorological officer and a specially trained wireless operator.

Combat aircraft often are detailed to report on weather conditions encountered during their operations. The outstanding example of this type of reporting is that of the long-range bomber units operating from Norway. Weather reconnaissance performed by these units has become almost as important as their anti-shipping reconnaissance.

Section IV. ARMY AND NAVY COOPERATION

Air Force cooperation may be of three types: direct or close support (tactical support); indirect support (strategic missions); and liaison.

1. Direct or Close Support

Close support usually is confined to the actual battle front and the area immediately behind it. It consists of bombing and strafing enemy ground forces, tanks, artillery, pillboxes, field defense works, antiaircraft defenses, forward dumps, and supply columns. It also includes air cover as protection for ground and Air Force units against enemy air attacks, and against enemy air reconnaissance. All types of aircraft may be used for these operations.

2. Indirect Support

Indirect support involves attacks on targets beyond the battle area such as rear maintenance and supply depots, enemy airfields, railroads, industrial centers, etc.

3. Liaison

Liaison between the Army and Air Force for

both army cooperation and tactical reconnaissance is provided by specially trained Air Force officers known as *Flivos* (*Fliegerverbindungs-offiziere*). The German Air Force support is requested by the Army units through their superior commands. The armies transmit the request to the competent headquarters authority where a German Air Force liaison officer (*Flivo*) is stationed. Such headquarters are generally those of Army groups. German Air Force Signal Liaison officers (*Fliegerverbindungs-offiziere* (*Ln*)) are stationed with Army corps headquarters and in some particular cases with division headquarters. A German Air Force Liaison Officer is specially assigned to Army Headquarters for the purpose of directing close cooperation between the Army and German Air Force reconnaissance units (*Fliegerverbindungs-offiziere* (*Aufklärung*)). For the control of the close support missions, which as a result of these requests are ordered by the German Air Force Command (*Fliegerkorps* or *Luftflotte HQ*), special German Air Force officers are stationed at the front line. These control officers (*Fliegerleit-offiziere*) direct the flying formations to their targets by radio from advanced observation posts on the ground.

Section V. EQUIPMENT

1. Aircraft

a. CONVENTIONAL TYPES. (1) *General.* The decision of the German Air Ministry to concentrate on mass production of a few selected types has led to the development of versatile aircraft capable of performing several duties. Therefore, certain types of aircraft fall into more than one category; i. e., the Junkers 88 is both a twin-engine fighter and bomber. The German Air Force has relied chiefly on the Focke-Wulf 190, Messerschmitt 109, and Junkers 88 to perform the major part of all fighter, day and night bomber, and reconnaissance missions. During the course of the war, however, improvements became necessary, and many sub-types have been produced. It was important to prevent these changes from interfering seriously with production schedules, and especially to avoid the substitution of entirely new types. Therefore most of the improvements consisted of modernizations and adaptations of existing types rather than the creation of completely new models. The most favored improvements were the installations of more powerful engines, additional armament, and heavier armor plate. When these modifications did not achieve the desired end, the plane's structure was changed. One of the outstanding weaknesses of early German planes—their lack of defensive armament and protective armor—received increased attention, and in many cases has been adequately remedied.

(2) *Single-engine fighters* (a) *General.* The German single-engine fighter force is made up of only two plane types—the Messerschmitt 109 and the Focke-Wulf 190. Both types are produced in several versions and series, but the basic design of each has remained unchanged. Improvements have been achieved mainly by installation of more highly powered engines and heavier armament. The principal developments in these fighters have been the introduction of special high-altitude versions and the conversion of the FW 190 into a fighter-bomber.

(b) *Important operational aircraft.* (1) *Messerschmitt 109.* This plane was the standard single-engine fighter at the beginning of the war. At present, it is one of two standard single-engine fighters and is used primarily for high-altitude defensive duties.

(2) *Focke-Wulf 190.* This is the first single-

engine fighter in the Air Force to use an air-cooled, radial engine. Of a more recent design than the ME 109, the FW 190 is a larger, cleaner plane. Its armor, armament, and simplified electrically operated controls are essential features that make it an exceptionally good medium-altitude fighter. It also is extensively used as a fighter-bomber with a normal bomb load of 550 pounds.

(3) *Twin-engine fighters.* (a) *General.* The Germans started the war with but one operational twin-engine fighter, the Messerschmitt 110. Attempts at introducing improved models (ME 210 and 410) encountered production difficulties, and these aircraft have not proved very successful as twin-engine fighters or been operational in large numbers. However, the German Air Force has adopted two of its long-range bombers as twin-engine fighters, the JU 88 and the DO 217. The fighter version of the JU 88 appeared in 1941, and this type since has been used in increasing numbers, now constituting a very substantial part of the German twin-engine fighter force. The DO 217 fighter is used primarily for night fighting, but has not achieved the success of the JU 88. Generally speaking, the night fighter branch of the German Air Force has constituted its most effective arm throughout the war.

(b) *Important operational aircraft.* (1) *Junkers 88.* Similar in appearance to its bomber prototype, except for the metal-panelled nose, the fighter version of the JU 88 is currently the most formidable German night fighter. It is relatively fast, heavily armed, and well protected. This type is employed for intruder and ground attack operations in addition to night fighting.

(2) *Dornier 217.* Likewise a modified bomber model, the DO 217 is used as a night-fighter, but has not proved as effective as the JU 88 in this category.

(4) *Ground attack aircraft.* The original JU 87 "Stuka" dive bomber, while still in limited use for night ground attack duty, has been largely superseded by faster single-engine fighters, equipped with bomb racks and known as fighter-bombers. The latter aircraft, of which the FW 190 is the best example, have the greater speed and maneuverability required by all ground attack operations without the necessity of strong fighter escort. The ME 262 jet plane also is being used for this type of operation.

(5) *Multi-engine bombers.* The long range bomber force has been relegated to a minor role

in German Air Force operations. Allied fighter superiority, combined with the necessity of increased German fighter production, largely has restricted bomber activities to mine laying and occasional night bombing. Principal types used are the JU 88, DO 217 and HE 111.

(6) *Transport planes.* Although a pre-war model, the Junkers 52 three-engine, low-wing monoplane is still the standard freight and troop carrying transport of the German Air Force. It also is used extensively for carrying and dropping parachute troops and as a glider tug. Other operational transport types include the six-engine Messerschmitt 323 and the four-engine Junkers 290. Converted bombers, such as the HE 111, also are employed frequently for heavy transport duty.

(7) *Gliders.* Gliders are of two types: powered and tow. Both resemble a conventional monoplane, but the tow glider lacks an engine and landing gear. The tow glider generally uses wheels during take-off and then jettisons them, subsequently landing on a skid. Both types of gliders are equipped with landing flaps and dive brakes, as well as navigation and landing lights.

The principal types of tow gliders are the DFS 230, GO 242 and ME 321. Principal powered gliders are ME 323 and GO 244.

(8) *Army cooperation and reconnaissance aircraft.* The standard type of Army cooperation plane, typified by the Henschel 126, has proved very vulnerable to modern fighters and antiaircraft fire. This has resulted in the employment of converted fighters, sufficiently fast, maneuverable, and armed to undertake short-range reconnaissance without fighter protection. Such conversion usually consists of replacing some of the armament with cameras. Recent development of high-speed jet aircraft has furnished the German Air Force with a highly desirable reconnaissance plane.

b. **GERMAN COMPOSITE OR "PICK-A'BACK" AIRCRAFT.** This innovation, still in the experimental stage, consists of a multi-motored plane with a large amount of explosive in the nose, surmounted and controlled by a single-engine aircraft. The latter directs the former in a dive towards the target and then releases it. Thereafter its operation is apparently by remote control. The usual components observed have been the JU 88 and the ME 109, but there is no reason to believe that other similar types could not be adapted for this purpose.

c. **JET- AND ROCKET-PROPELLED.** (1) *General.* The perfection and application of jet and rocket propulsion as motive power for aircraft are outstanding German aeronautical developments of the current war. To counter this new type aircraft, if it is employed on any appreciable scale, might well necessitate a general revision of defensive and offensive aerial tactics. Required changes or improvements also might extend to include ground defenses against attacks by these aircraft. To date the Germans have not employed jet or rocket aircraft on a sufficient scale to permit full and accurate assessment of their characteristics and possibilities. Those currently in use, however, appear to possess significant advantages over conventional types. In level flight, dives, and rate of climb all known conventional types have been surpassed by aircraft with this type of motive power. The propellerless power unit is capable of operation on the lowest grade fuels, and the absence of many intricate parts, necessary in conventional types, probably greatly simplifies assembly and repair methods.

(2) *Types.* Operational types of German jet and rocket aircraft thus far have been limited to those powered by single or twin-units. They have been employed to date as defensive fighters, as ground-attack or low-altitude bombers, and for reconnaissance. For the latter purpose they have proved to be very effective because of their speed.

(a) The only rocket-propelled aircraft known to be operational by the German Air Force is the Messerschmitt 163 (ME 163). It is a very fast, single-seat fighter. Although it has only a single power unit, it has a remarkable rate of climb. Because of its present limited endurance, to date it has seen comparatively little use, particularly in forward areas.

(b) The Messerschmitt 262 (ME 262), a twin-unit, jet-propelled aircraft, has proved to be the most successful of the German jet or rocket types thus far developed. Employed as a fighter, as a ground-attack or low-level bomber, and for reconnaissance duties, it is the most versatile of the jet or rocket aircraft yet introduced by the Germans.

(c) Other German twin-unit jet aircraft, either currently operational on a limited scale or expected to become operational in the near future, are the Arado 234 (AR 234) and Heinkel 280 (HE 280). Both of these aircraft are somewhat similar to the Messerschmitt 262 in appearance

and are expected to be about equal in performance.

d. NAVAL AND MARINE. At present, naval and marine aircraft are operated by the German Air Force on a limited scale. The use of the BV 138 for reconnaissance in the Norway and Denmark areas is the principal duty performed by this type of aircraft. Other types, such as the HE 115 and AR 196, are employed for general reconnaissance and liaison with the various naval testing units operating in the Baltic Sea, and for the performance of air/sea rescue service. In addition, naval aircraft such as the BV 222 are occasionally used for marine supply and transport duty.

2. Power Units

a. ENGINES. The German Air Force has equipped practically all operational aircraft with engines manufactured by three large companies: Daimler-Benz (D.B.); the *Bayerische Motoren Werke* (B.M.W.); and the Junkers (Jumo). The trend of aeronautical engine development has been toward more powerful engines with increased altitude performance. German aero-engine designers have obtained this by modifying existing engines to use GM-1 (nitrous oxide) and MW-50 (methanol injection) apparatus and, in certain instances, by coupling two existing engines together. Lack of time for experimentation with new engines has led to the modification of existing types which could be more quickly put into service in war time.

b. JET PROPULSION UNITS. An outstanding achievement in the field of aircraft power units has been the development of jet propulsion, an example being the Junkers Jumo 004. This unit often is referred to as a jet-propulsion turbine, or turbo jet. Propulsion is developed through the reaction to ejected hot gases which have been created by compressed air igniting with liquid fuel. As these gases pass out to the vents they traverse a turbine, which in turn operates the air compressor. Original momentum of the turbine is created by an auxiliary engine which disengages when the turbine has developed sufficient speed to create the required compression. German aircraft using jet propulsion turbines include the Messerschmitt 262, Arado 234 and Heinkel 280.

c. ROCKET-PROPULSION UNITS. A closed unit in which fuel is burned or gasified, a rocket does not require air from the atmosphere for combustion. The gases leave through a nozzle at the rear to provide thrust by jet propulsion. Fuels are of three types: solids, (e. g., cordite); two liquids, one a fuel, (e. g., gasoline), and the second an oxidizing agent (e. g., liquid oxygen); or a single liquid with or without liquid as a catalyst, (e. g., hydrogen peroxide with potassium or sodium permanganate).

3. Armament

The Germans started the war with only a few types of aircraft armament, in order to standardize manufacture and achieve large-scale production. As the war progressed, improvements became necessary and many changes and additions have been made. In addition to increasing the rate of fire, muzzle velocity, and caliber of aircraft armament, the number of guns on German Air Force fighters has been greatly increased. The addition of the Model 108 30-mm cannon, a new weapon in aircraft armament, to FW 190's, ME 262's, ME 110 G's and ME 109 G's stands out as a great advancement, in terms of striking power. A detailed discussion of the various types of aircraft armament can be found in Chapter VII, Section IX.

4. Armor

The armor protection in German planes varies in thickness from 4 to 20 mm. The total weight per plane may vary from 100 pounds or less in some army cooperation types to over 1,000 pounds for a ground-attack plane. The demands of modern warfare have necessitated increased protection of the pilot as well as of the engine and accessory equipment. Other crew members are normally protected by plates on the sides and floor of the plane.

5. Tabulated Data

Specifications given are for the principal types in current operation. The following type abbreviations are used:

LWM—Low Wing Monoplane.
HWM—High Wing Monoplane.
MWM—Mid-Wing Monoplane.
TT—Twin tails.
TB—Twin tail booms.

FIGHTERS

1 MARCH 1945

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
<i>Single-engine</i> (1) Focke-Wulf FW 190	LWM	1	1xBMW 801D 14 cyl. twin-row, air-cooled radial— 1755 HP	34'6"	385 at 19,000 ft.	175	<i>Forward fuselage</i> 2x7.9-or 13-mm. <i>Forward wings</i> 2/4x20-mm.	2x21-cm rockets under wings	8,600	36,000
(2) Focke-Wulf FW 190 (Long nose)	LWM	1	Jumo 213—12 cyl. liquid-cooled —1700 HP or DB603—12 cyl. liquid-cooled— 1800 HP	34'6"	435 (est.)	160 (est.)	<i>Forward fuselage</i> 2x7.9- or 13-mm. <i>Forward wings</i> 2/4x20-mm.		9,000 (est.)	36,000 (est.)
(3) Messerschmitt ME 109	LWM	1	1xDB 605A/1 12 cyl. liquid- cooled—1460 HP	32'8"	400 at 22,000 ft.	175	<i>Forward fuselage</i> 2x7.9- or 13-mm. <i>Forward wings</i> 2 x 20-mm. Prop. hub 1x20-mm.	2x21-cm rockets under wings	6,820	38,500
<i>Twin-engine</i> (1) Dornier DO 217 J	HWM	3	2xBMW 801D 14 cyl. twin-row, air-cooled radial— 1755 HP	62'5"	328 at 20,000 ft.	470	<i>Forward fuselage</i> 4x7.9-mm plus 4x20-mm. <i>Dorsal</i> 1x13-mm. <i>Ventral</i> 1x13-mm.		27,500	29,000
(2) Heinkel HE 219	MWM	2 (est.)	2xDB 603 12 cyl. liquid- cooled—1800 HP	60'6"	400 at 22,000 ft. (est.)	600 (est. max.)	<i>Forward wings</i> 2x20-mm. <i>Dorsal</i> 2x20-mm. <i>Ventral</i> 4x24- or 30-mm.		26,100	32,800

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FIGHTERS—Continued

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(3) Junkers JU 88 C-6	LWM	3	2xJumo 211J 12 cyl. liquid-cooled—1380 HP	65'11"	295 at 14,000 ft.	285	<i>Forward fuselage</i> 1/3x20-mm plus 3x7.9-mm. <i>Dorsal</i> 2x7.9-mm plus 2x20-mm. <i>Ventral</i> 2x7.9-mm.		24,000	24,200
(4) Messerschmitt ME 110	LWM	2	2xDB 601F 12 cyl. liquid-cooled—1395 HP	53'11"	360 at 20,000 ft.	275	<i>Forward fuselage</i> 4x7.9 mm plus 2/4x20-mm. <i>Dorsal</i> 2x7.9-mm.		16,200	34,000
(5) Messerschmitt ME 410 ¹	LWM	2	2xDB 603 A-2 12 cyl. liquid-cooled—1680 HP	53'7"	395 at 22,000 ft.	415	<i>Forward fuselage</i> 2/4x20-mm or 2x30-mm plus 2x47-mm or 1x37- or 50-mm plus 2x7.9-mm. <i>Dorsal</i> 2x13-mm.		24,000	30,000

¹ No technical data available for the rocket- and jet-propelled fighters Messerschmitt ME 163 and ME 262, Arado AR 234, and Heinkel HE 280.

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Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
<i>Single-Engine</i> (1) Junkers JU 87 (Stuka) (Dive-bomber)	Inverted Gull Wing	2	1xJumo 211 J 12 cyl. liquid-cooled—1335 HP	45'4"	255 at 13,500 ft.	280	<i>Forward fuselage</i> 2x12.7-mm. <i>Forward wings</i> 2x7.9-or 37-mm. <i>Dorsal</i> 2x7.9-mm.	2,200	12,600	18,500
(2) Focke-Wulf FW 190 (Fighter-bomber)	LWM	1	1xBMW 801D 14 cyl. twin-row, air-cooled radial— 1755 HP	34'6"	370 at 19,000 ft.	165	<i>Forward fuselage</i> 2x7.9-or 13-mm. <i>Forward wings</i> 2/4x20-mm.	550	9,800	31,500
<i>Twin-Engine</i> (1) Henschel HS 129	LWM	1	2xGnome-Rhone 14M 04/05, 14 cyl. twin-row, air-cooled radial— 800 HP	44'6"	275 at 9,000 ft.	220	<i>Forward fuselage</i> 2x7.9-mm plus 2x15-or 20-mm plus 1x30-mm or 6x7.9-mm. <i>Dorsal</i> Possibly 2x20-mm.	220	11,400	25,000
(2) Dornier DO 217 K-2	HWM	4	2xBMW 801 A-2 14 cyl. twin-row, air-cooled radial— 1595 HP	80'6"	325 at 20,000 ft. (est.)	470	<i>Forward fuselage</i> 2x7.9-mm or larger caliber <i>Dorsal</i> 1x13-mm. <i>Lateral</i> 2x7.9-mm. <i>Ventral</i> 1x13-mm. <i>Tail</i> 4x7.9-mm.	6,600	35,000	25,000

BOMBERS—Continued

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(3) Heinkel HE 111	LWM	5/6	2xJumo 211F 12 cyl. liquid-cooled—1230 HP	74'	252 at 14,000 ft.	215	Forward fuselage 1x20-mm plus 1/2x7.9-mm. Dorsal 1x13-mm. Ventral 2x7.9-mm.	2,020	25,500	26,000
(4) Heinkel HE 177	MWM	7	2xDB610 (DB 605 doubled) 24 cyl. liquid-cooled—2800 HP	103'6"	300 at 20,000 ft.	460	Forward fuselage 1x7.9-mm. Forward dorsal 1/2x13-mm. Rear dorsal 1/2x13-mm. Forward ventral 1x20-mm. Rear ventral 1x13-mm. Tail 1x20-mm.	12,320	68,000	21,000
(5) Junkers JU 88 A-4	LWM	4	2xJumo 211J 12 cyl. liquid-cooled—1335 HP	65'11"	291 at 14,000 ft.	490	Forward fuselage 1/2x7.9-mm and/or 1x20-mm. Dorsal 2x7.9-mm. Ventral 2x7.9-mm.	4,400	28,300	24,200
(6) Junkers JU 88 S	LWM	3	2xBMW 801 G-2 14 cyl. twin-row, air-cooled radial— 1530 HP (est.)	65'11"	339 at 20,000 ft.	245	Forward fuselage 1x7.9-mm. Dorsal 1x13-mm.	1,980	26,400	30,000

BOMBERS—Continued

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(7) Junkers JU 188 (Estimated performance)	LWM	4	2xJumo 213 A/1 12 cyl. liquid-cooled—1700 HP (est.)	72'6"	325 at 20,000 ft.	320	<i>Forward fuselage</i> 1x20-mm. <i>Cockpit rear</i> 1x13-mm. <i>Dorsal turret</i> 1x20-mm. <i>Ventral</i> 2x7.9-mm or 1x13-mm.	4,400		33/ 34,000
(8) Messerschmitt ME 110G	LWM	2	2xDB 605B, 12 cyl. liquid-cooled—1460 HP	53'11"	325 at 19,000 ft.	250	<i>Forward fuselage</i> 4x7.9-mm plus 2x20-or 30-mm. <i>Dorsal</i> 2x7.9-mm.	2,640	20,900	29,000
<i>Four-Engine</i> Focke-Wulf FW 200	LWM	5/7	4xBramo "FAFNIR" 323 R, 9 cyl. air-cooled radial—1,000 HP	107'7"	240 at 13,000 ft.	750	<i>Dorsal forward</i> 1x15-or 20-mm. <i>Rear dorsal</i> 1x13-mm. <i>Lateral</i> 2/4x7.9-mm or 2x13-mm. <i>Forward ventral</i> 1x15-or 20-mm. <i>Rear ventral</i> 1x7.9-, 13-, or 20-mm.	3,600	50,000	20,500

TRANSPORT AND GLIDER TUGS

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(1) Arado AR 232 (performance and characteristics estimated)	HWM TT	3/4	2xBMW 801 A or L 14 cyl. twin-row, air-cooled radial— 1595 HP	104'	210 at 18,000 ft.	350/400	<i>Forward fuselage</i> 1 MG <i>Lateral</i> 4 MGs	9,000	45,000	20,000
(2) Gotha GO 244 (Twin-engine powered version of GO 242 glider)	HWM TB	2	2xGnome-Rhone 14 m, 14 cyl. twin-row, air- cooled radial— 800 HP	79'	169 at 10,000 ft.	145	<i>Forward fuselage</i> 1/2x7.9-mm. <i>Dorsal</i> 1x7.9-mm. <i>Lateral</i> 4x7.9-mm. <i>Tail</i> 1x7.9-mm.	4,400 or 23 men	17,500	19,000
(3) Junkers JU 52	LWM	3/4	3xBMW 132A A/T 9 cyl. air-cooled radial—660 HP	95'11"	165	210	<i>Forward fuselage</i> 1x7.9-mm. <i>Dorsal</i> 1x7.9-mm. <i>Lateral</i> 2x7.9-mm. <i>Ventral</i> 1x7.9-mm.	5,000 or 22 men	23,100	16,000
(4) Junkers JU 90	LWM	5	4xBMW 132 H 9 cyl. air-cooled radial—830 HP	115'	218 at 3,500 ft.	315	<i>Forward fuselage</i> 1x7.9-mm. <i>Dorsal</i> 1x13-mm. <i>Ventral</i> 1x7.9-mm.	9,000 or up to 70 men	51,000	15,000

TRANSPORT AND GLIDER TUGS—Continued

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(5) Junkers JU 252	LWM	6	3xBMW 801 14 cyl. twin-row, air-cooled radial— 1755 HP	111' (est.)	235 at 18,500 ft.	Unknown	<i>Dorsal</i> 1x13-or 20-mm. <i>Lateral</i> 7x7.9-mm. <i>Ventral</i> 1x13-mm. <i>Tail</i> 1x13-or 30-mm.	12,000 (est.) or 35 men	45,000 (est.)	26,000 (est.)
(6) Junkers JU 290	LWM TT	4/7	4xBMW 801 L-2 14 cyl. twin-row, air-cooled radial— 1500 HP	138'	243 at 18,000 ft.	395	<i>Forward fuselage</i> 1x20-mm. <i>Dorsal</i> 1x15-or 20-mm. <i>Lateral</i> 4 or 6x7.9-mm or 2x13-mm. <i>Ventral</i> 1x13-mm, forward and 1x20-mm, rear <i>Tail</i> 1x20-mm.	19,000 or up to 90 men	90,000	19,000
(7) Messerschmitt ME 323	HWM	8/10	6xGnome-Rhone 14N 48/49, 14 cyl. twin-row, radial—965 HP	181'	195 at 13,000 ft.	255	<i>Fuselage</i> 2x7.9-mm, upper 2x7.9-mm, lower <i>Dorsal</i> 4x7.9-mm, forward plus 2x7.9-mm, rear <i>Lateral</i> 6x7.9-mm. <i>Ventral</i> 2x7.9-mm.	26,900 or 60/100 men	85,000	23,000

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GLIDERS

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(1) Gotha DFS 230	HWM	1 or 2	None	72'4"	Dependent tug.	on type of	Light MG can be carried	2,800 or 10 men	4,700	
(2) Gotha GO 242	HWM TB	2	None	79'	Dependent tug.	on type of	<i>Fuselage</i> 1 or 2x7.9-mm. <i>Dorsal</i> 1x7.9-mm. <i>Tail</i> 1x7.9-mm.	5,300 or 23 fully equipped troops	12,500	
(3) Messerschmitt ME 321 "GIGANT"	HWM	1 or 2	None	181'	Dependent tug.	on type of	<i>Lateral</i> possibly 6x7.9-mm.	26,000 or 130 men	50,000	

RECONNAISSANCE AND ARMY COOPERATION

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(1) Henschel HS 126	HWM	2	1xBramo "Fafnir" 323, 9 cyl. air-cooled radial—1,000 HP	47'7"	230 at 15,000 ft.	210	<i>Forward fuselage</i> 1 or 2x7.9-mm. <i>Cockpit</i> 1x7.9-mm. <i>Dorsal</i> 2x7.9-mm.	220	7,250	27,000
(2) Fieseler FI 156	HWM	2 or 3	1xArgus As 10C/3, 8 cyl. air-cooled, inverted "V"—240 HP	46'8"	110 at S.L.	95	<i>Dorsal</i> 1x7.9-mm.	220	2,250	15,000

NAVY TYPES

Aircraft Manufacturer and Model	Type	Normal Crew	Engines, Model, and Rated HP	Wing Span	Max. Speed MPH	Radius of Action (40% Normal Range) (Miles)	Typical Armament	Bomb or Freight Load (Pounds)	Normal Weight (Pounds)	Service Ceiling (Feet)
(1) Arado AR 196	LWM (Float)	2	1xBMW 132 K, 9 cyl. air-cooled radial—920 HP	41'	195 at S.L.	185	<i>Fuselage</i> 1x7.9-mm. <i>Forward wings</i> 2x20-mm. <i>Dorsal</i> 2x7.9-mm.	220	6,600	21,500
(2) Blohm & Voss BV 138	HWM TB (Flying boat)	5 or 6	3xJumo 205 D 6 cyl. liquid-cooled Diesel 700 HP	88'7"	175 at S.L.	395	<i>Forward fuselage</i> 1x15-or 20-mm. <i>Dorsal</i> 1x13-mm. <i>Tail</i> 1x15-or 20-mm.	660	30,800	17,000
(3) Blohm & Voss BV 222 (Performance estimated)	HWM	10	6xBMW 801 A, 14 cyl. twin-row, air-cooled radial—1595 HP	150'10"	200/240 at 15/17,000 ft.	1,400 to 1,800	<i>Forward fuselage</i> 1x13-or 15-or 20-mm. <i>Dorsal</i> 2x15-or 20-mm. <i>Lateral?</i>	45,000 (est.) up to 116 men	45,000	18,000
(4) Heinkel HE 115	MWM (Twin Floats)	3	2xBMW 132 K, 9 cyl. air-cooled radial—920 HP	72'6"	185 at S.L.	490	<i>Forward fuselage</i> 1x7.9-and 1x15-mm. <i>Engine nacelles</i> 2x7.9-mm. <i>Dorsal</i> 1x7.9-mm.	1,100	23,500	18,500

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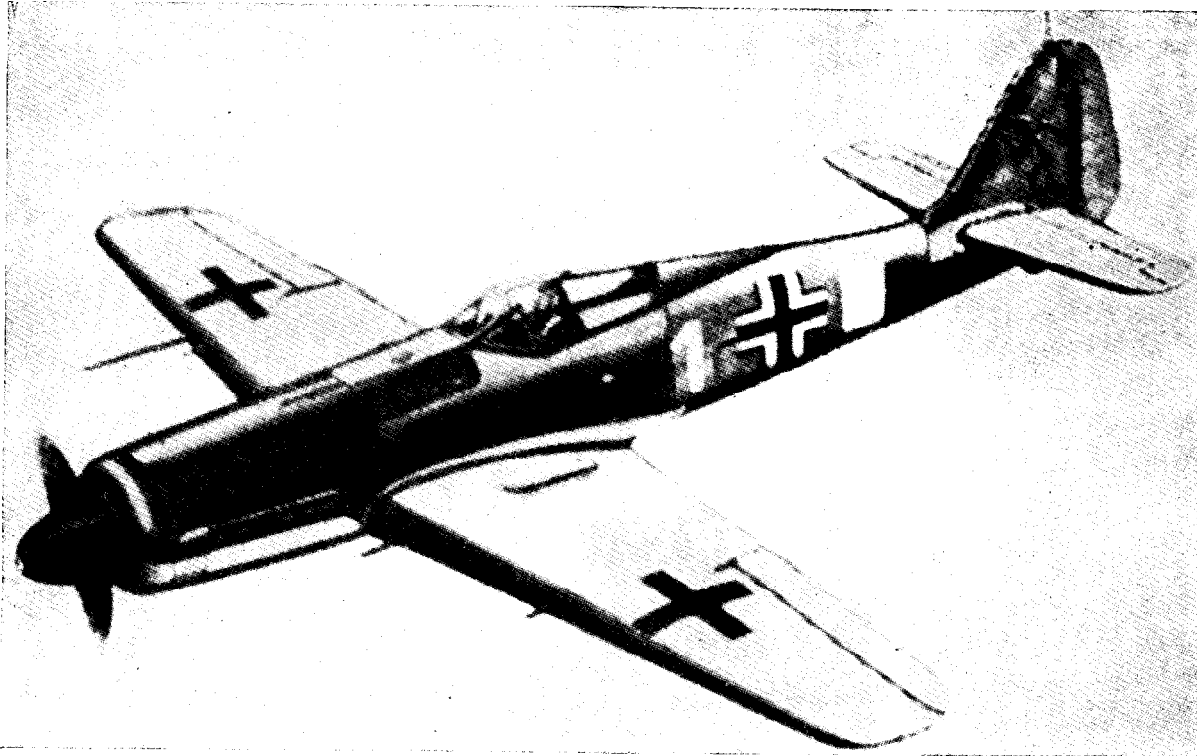


Figure 3.—FW 190 Single-Engine Fighter-Bomber with DB 603 Engine.

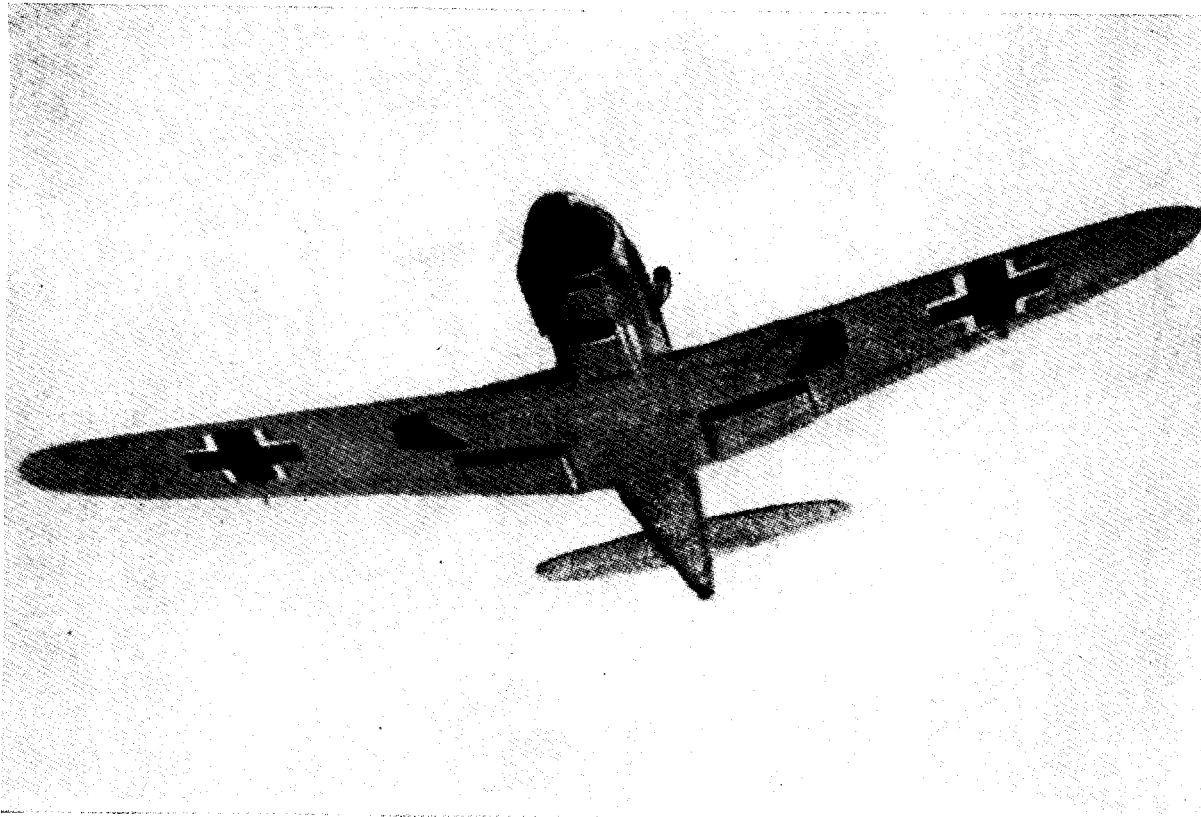


Figure 4.—ME 109 F Single-Engine Fighter-Bomber.

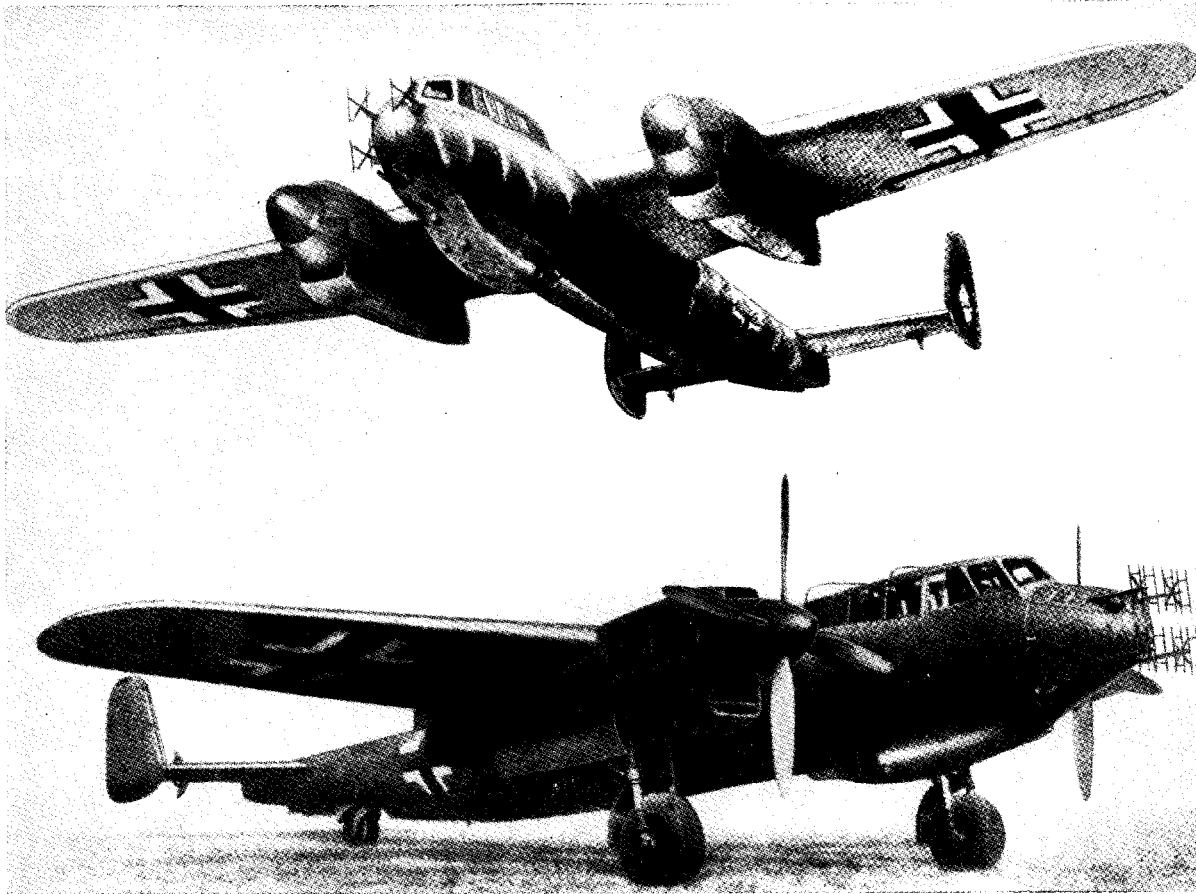


Figure 5.—DO 217 J Twin Engine Night Fighter.

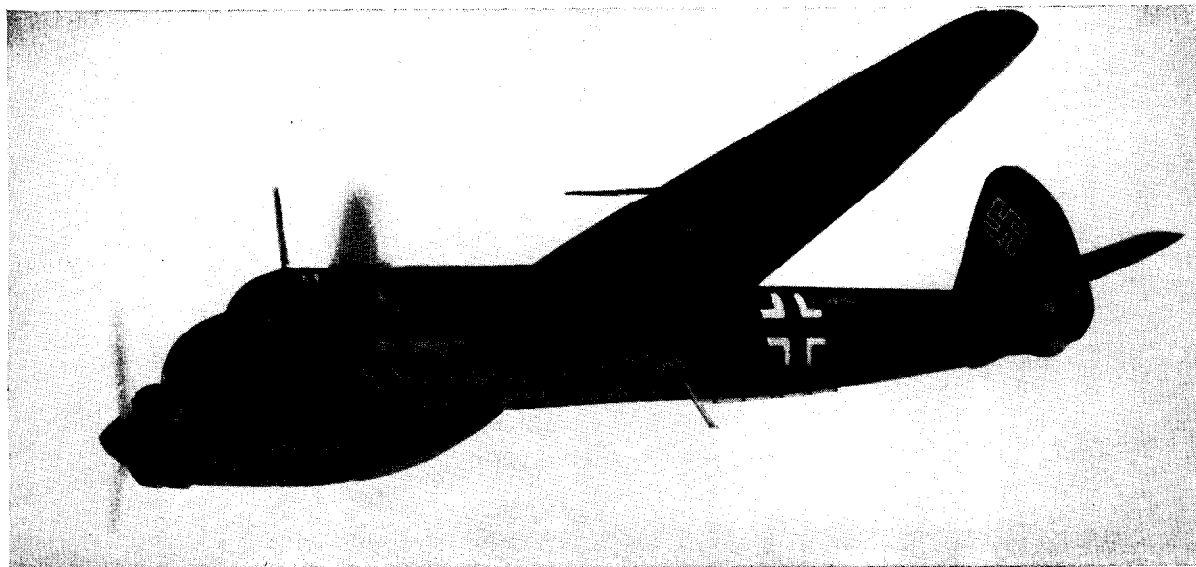


Figure 6.—JU 88 C-6 Twin-Engine Fighter.

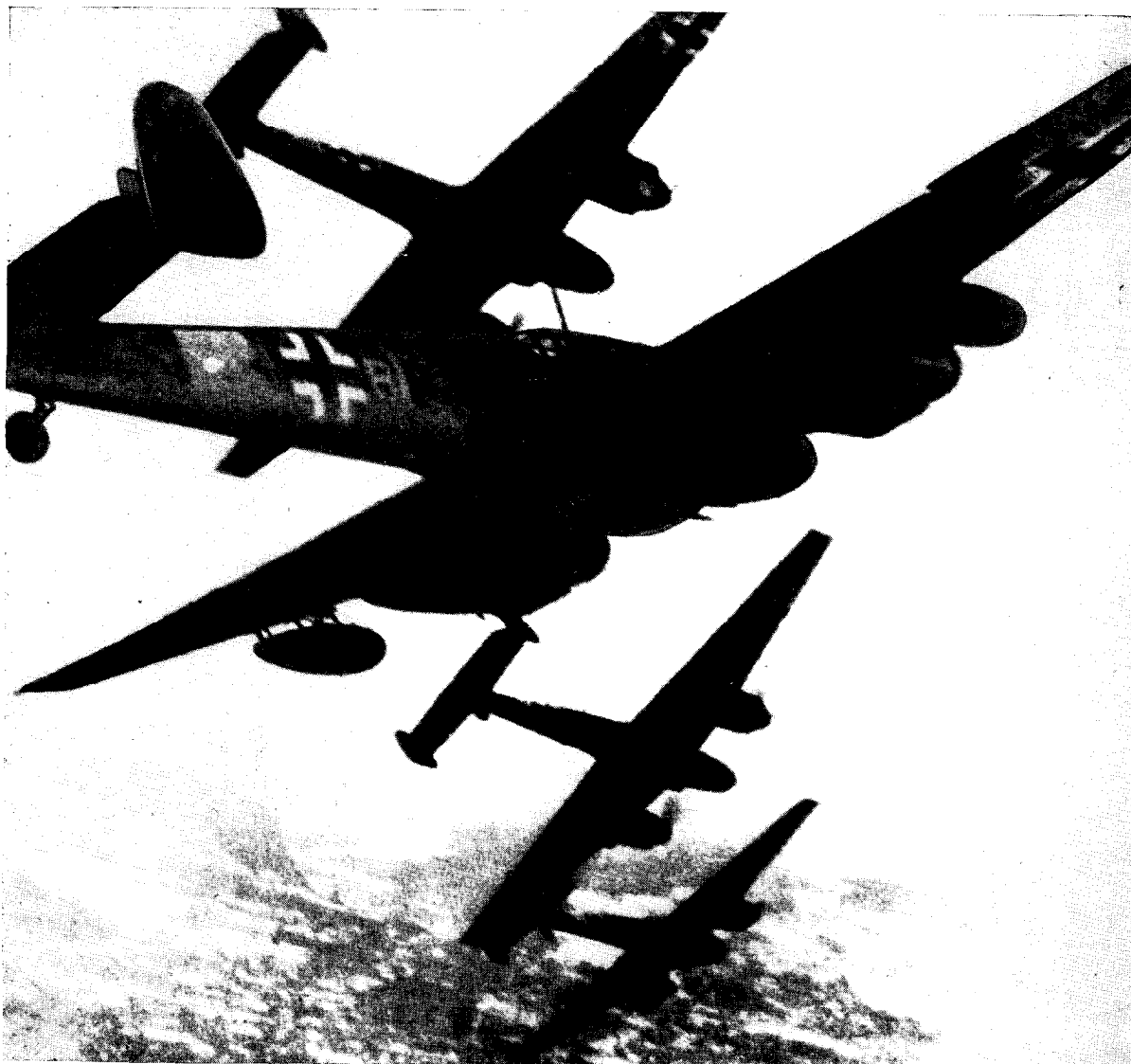


Figure 7.—ME 110's in action.

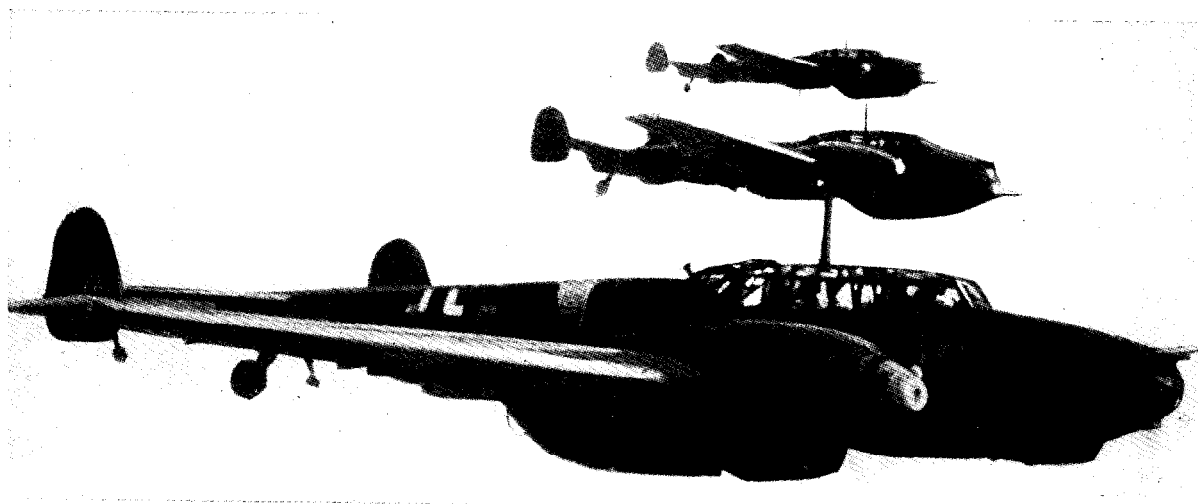


Figure 8.—ME 110 Twin-Engine Fighter Bomber.



Figure 9.—ME 110 Twin-Engine Fighter-Bomber.

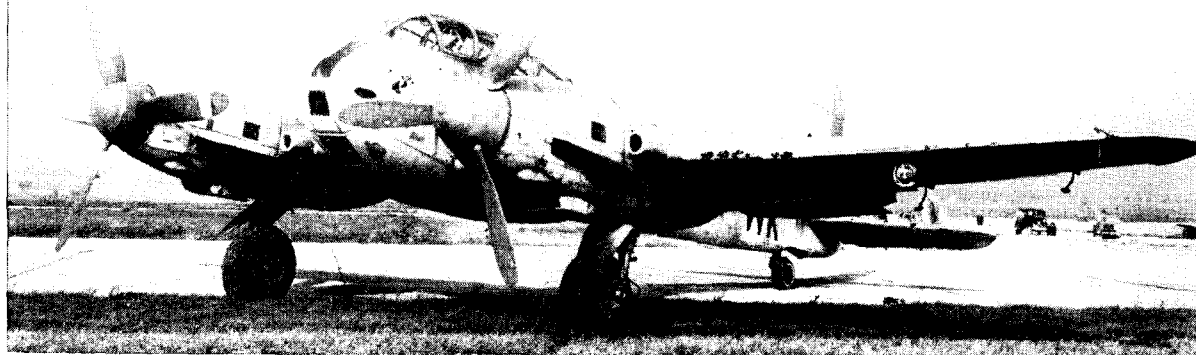


Figure 10.—ME 410 Twin-Engine Fighter-Bomber.



Figure 11.—JU 87 (Stuka) Twin-Engine Dive Bomber.

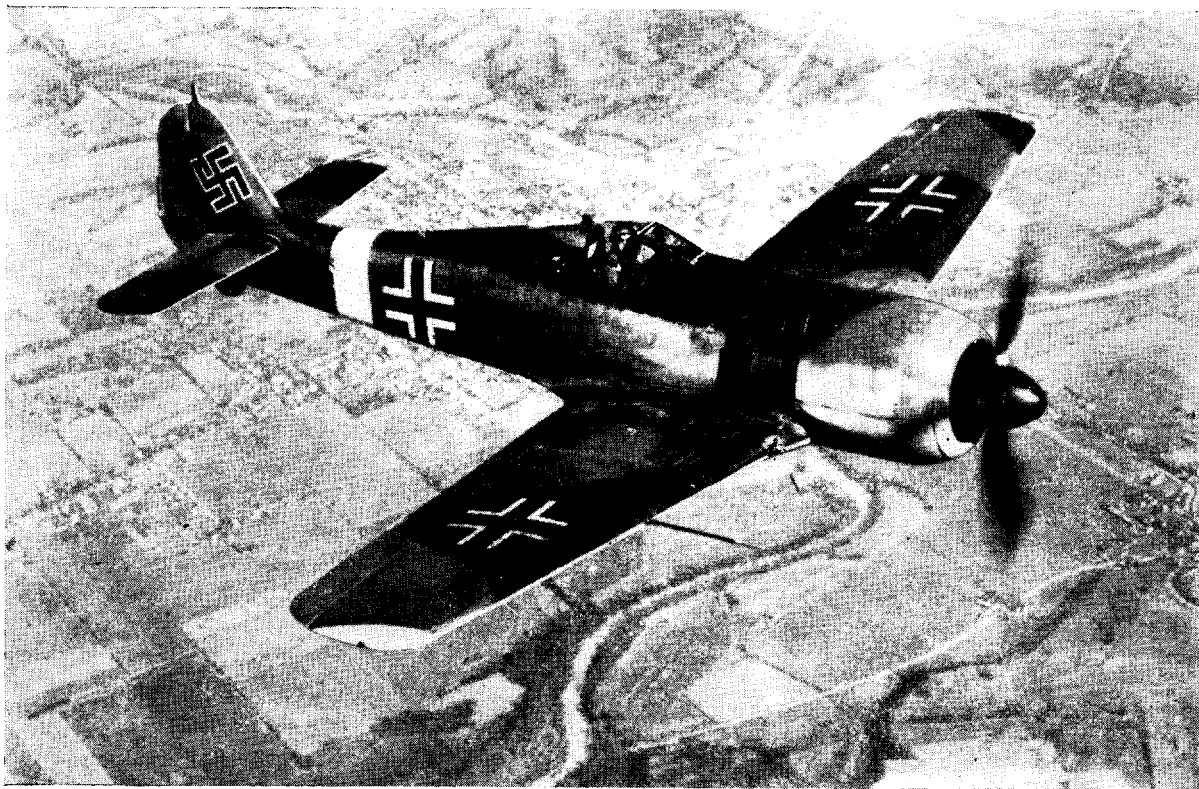


Figure 12.—FW 190 Single-Engine Fighter-Bomber.

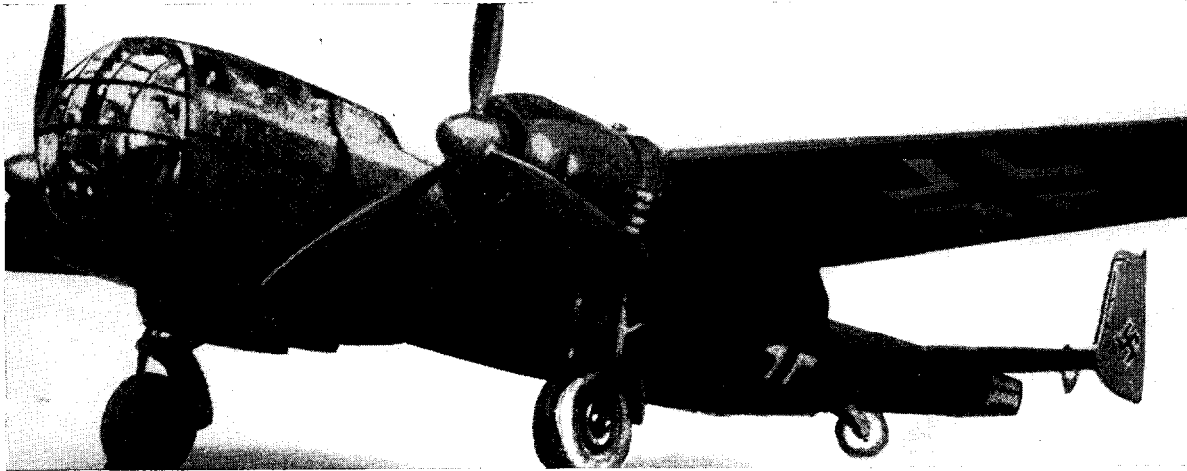


Figure 13.—DO 217 K-2 Twin-Engine Bomber.

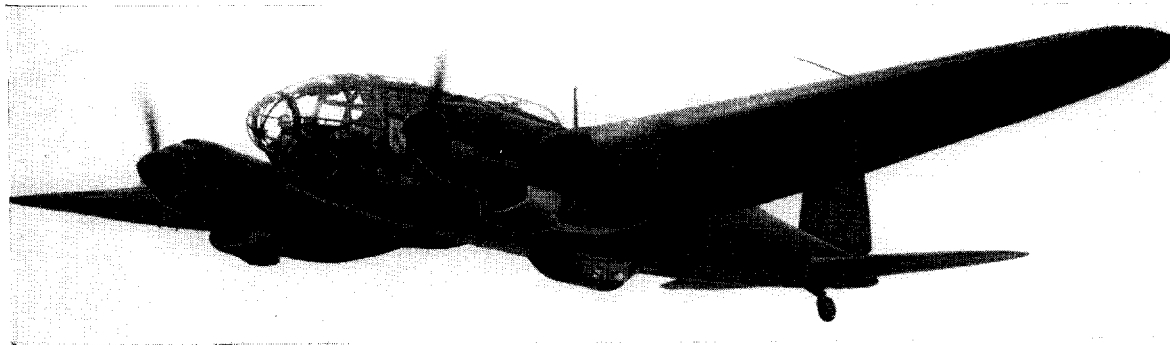


Figure 14.—HE 111 Twin-Engine Bomber.

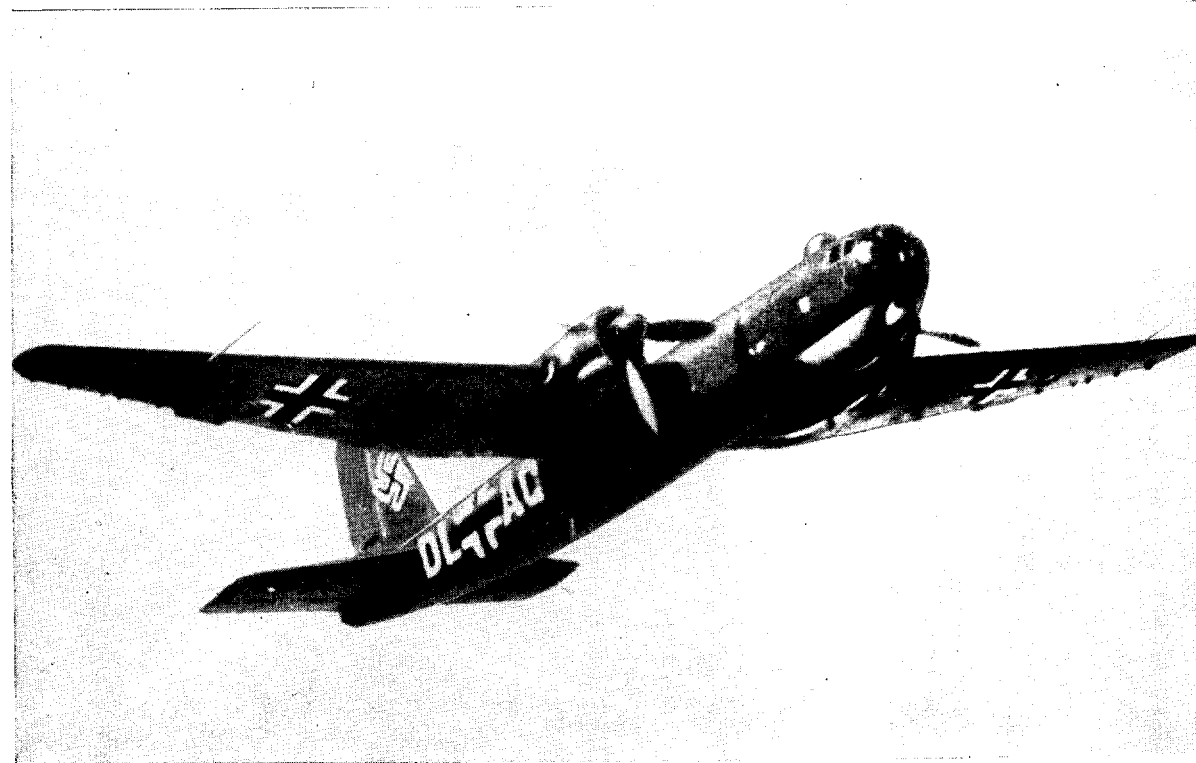


Figure 15.—HE 177 Twin "Doubled" Engine Bomber.

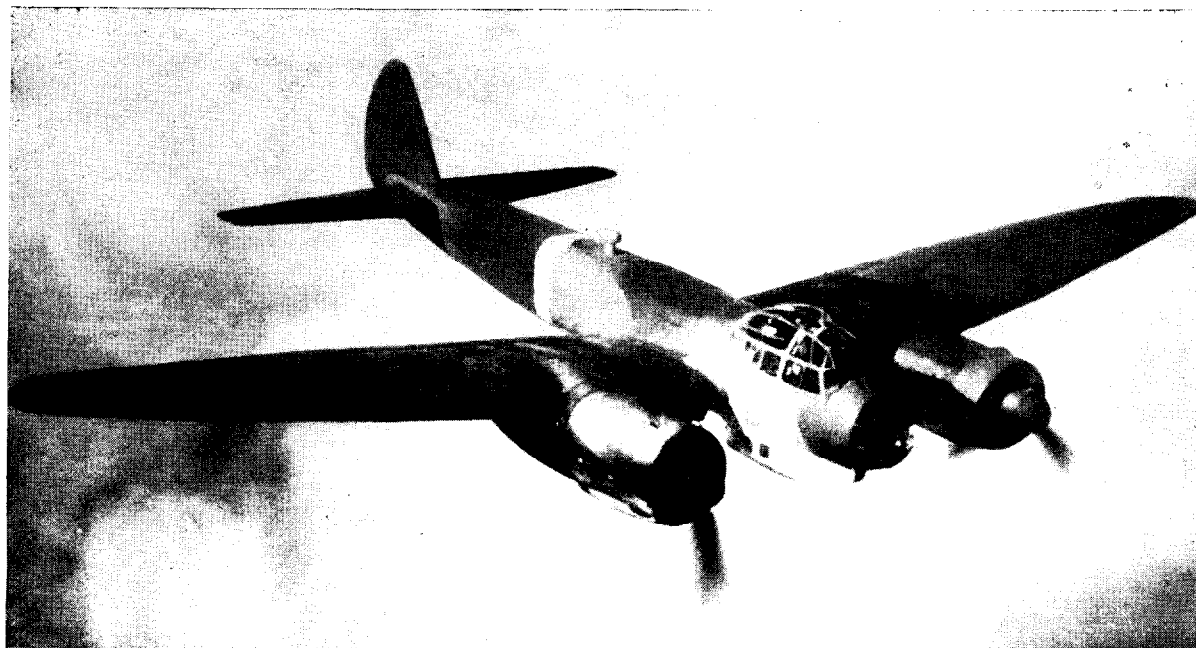


Figure 16.—JU 88 A-4 Twin-Engine Bomber

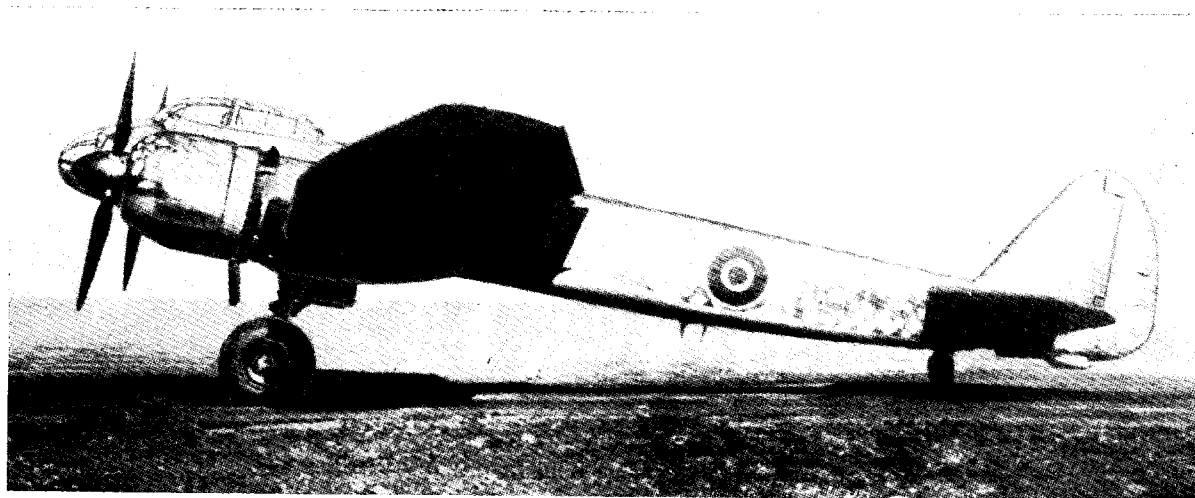


Figure 17.—JU 88 S Twin-Engine Bomber



Figure 18.—JU 188 Twin-Engine Bomber



Figure 19.—FW 200 C Four-Engine Bomber

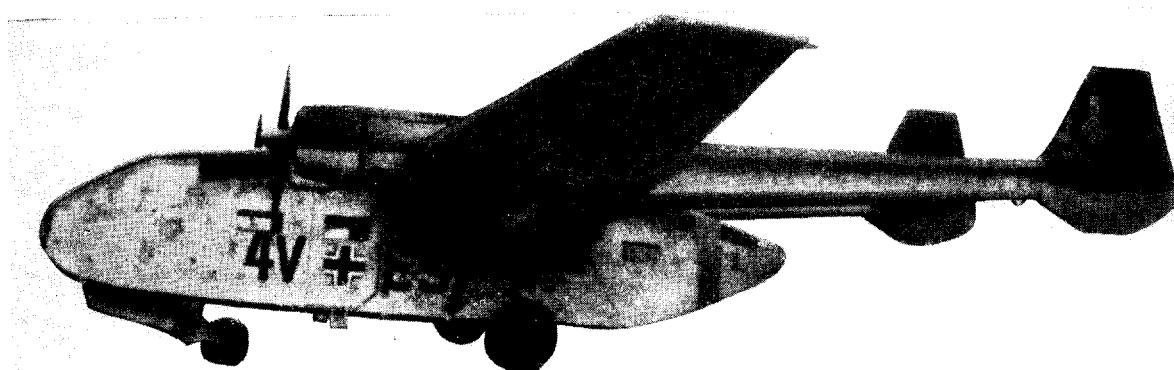


Figure 20.—GO 241 Twin-Engine Transport

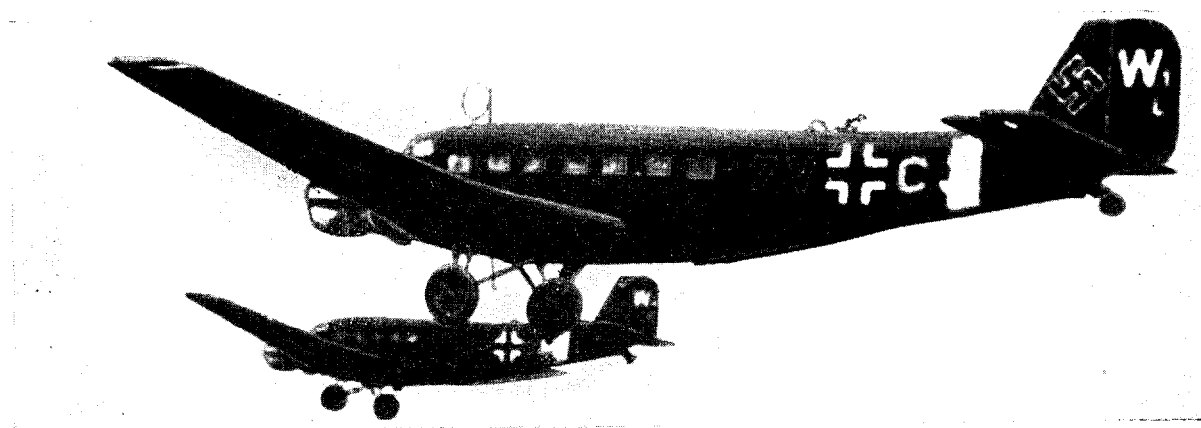


Figure 21.—JU 52 Three-Engine Transport/Glider



Figure 22. Me 323 Six-Engine Transport.

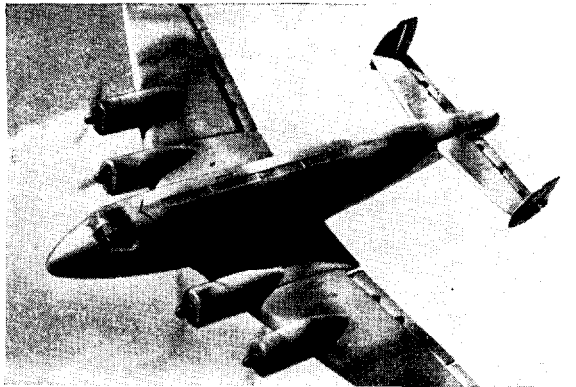


Figure 23.—JU 90 Four-Engine Transport/Glider Tug.

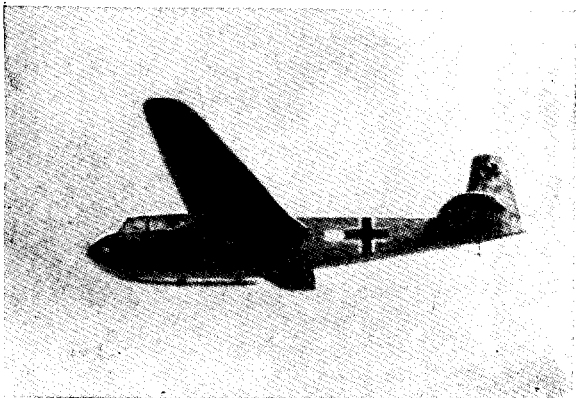


Figure 24.—DFS 230 Glider.

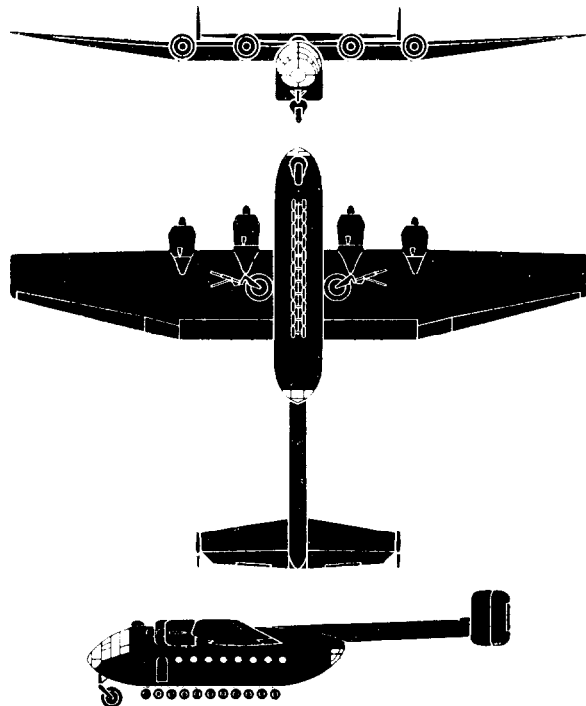


Figure 25. AR 232 Four-Engine Transport.

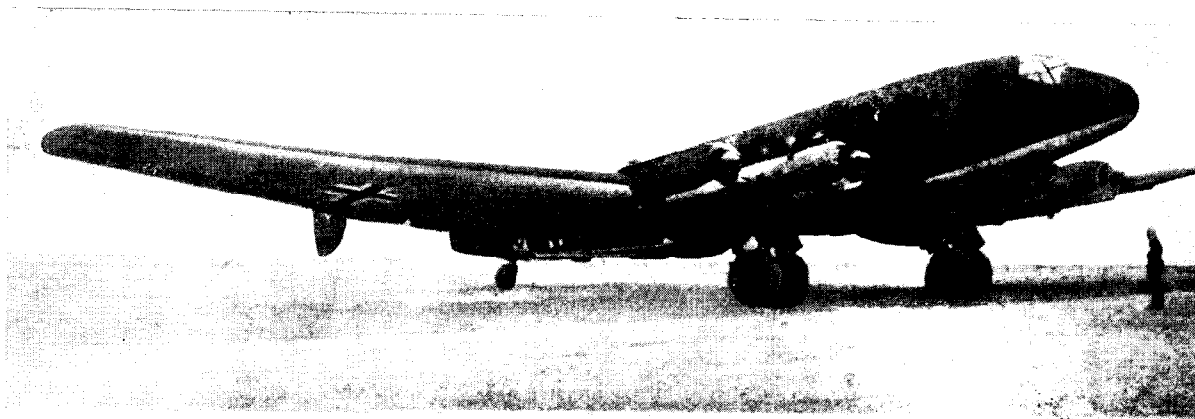


Figure 26.—U-200 Four-Engine Transport

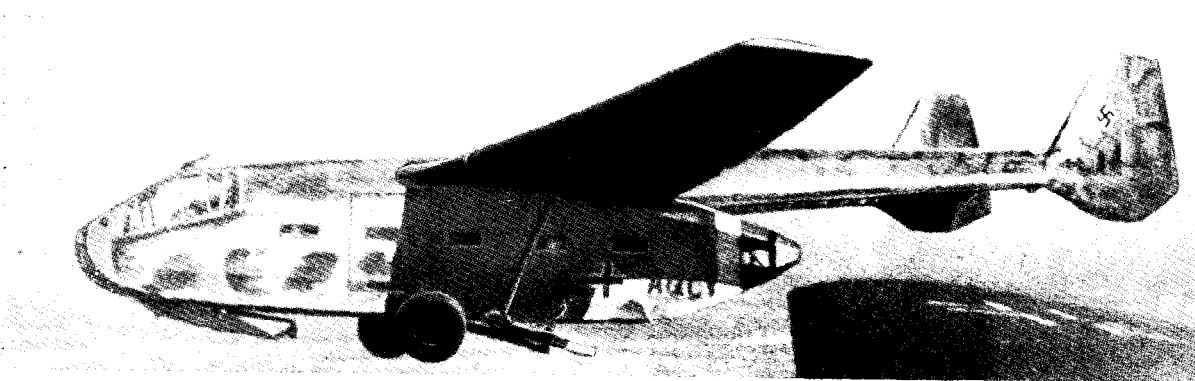


Figure 27.—Go 242 Glider.

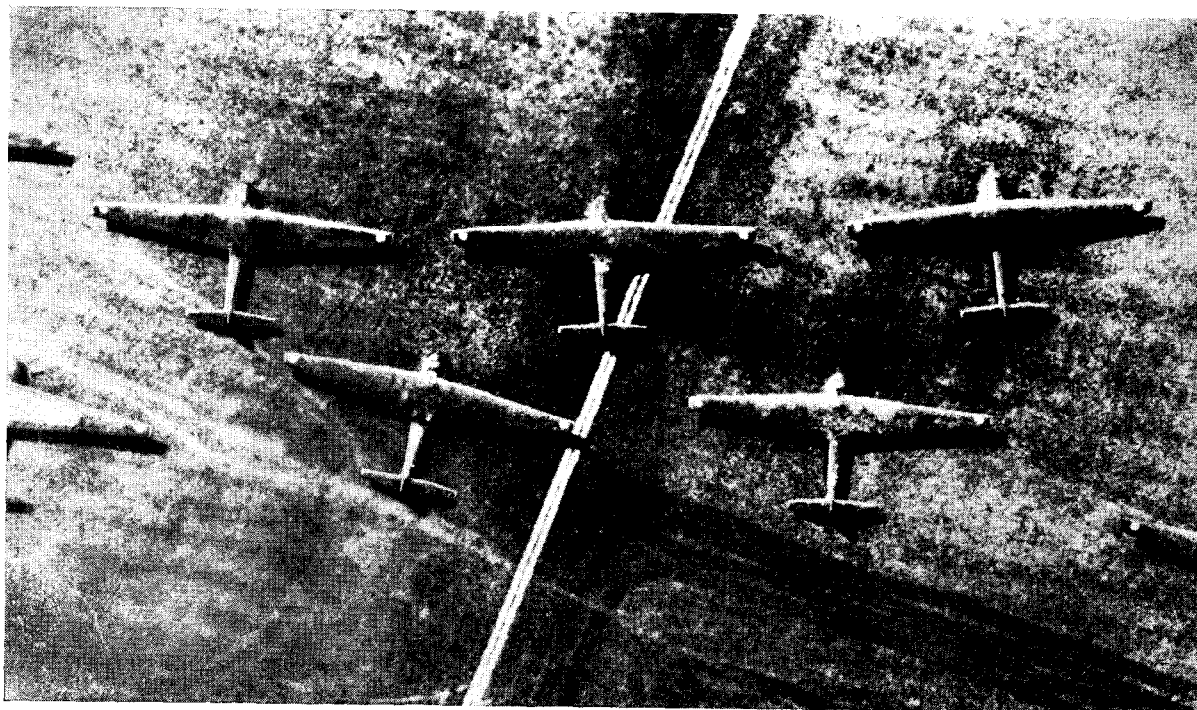


Figure 28.—ME 321 "Giant" Glider.



Figure 29. HHS 126 Single-Engine Army Cooperation.

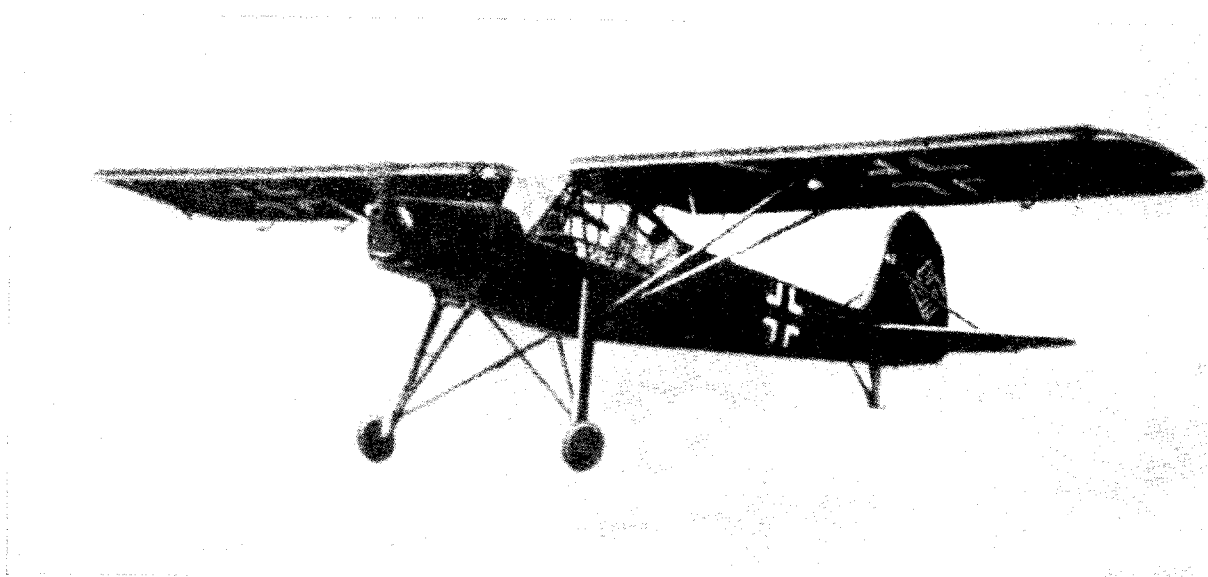


Figure 30.—FI 156 "Storch" Single-Engine Army Cooperation.

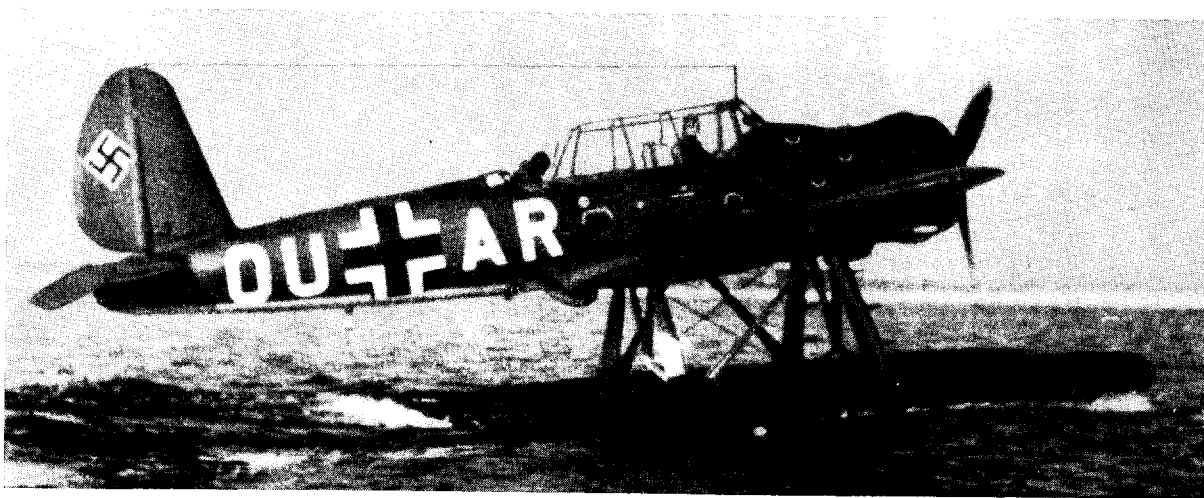


Figure 31.—AR 196 Single-Engine Floatplane.

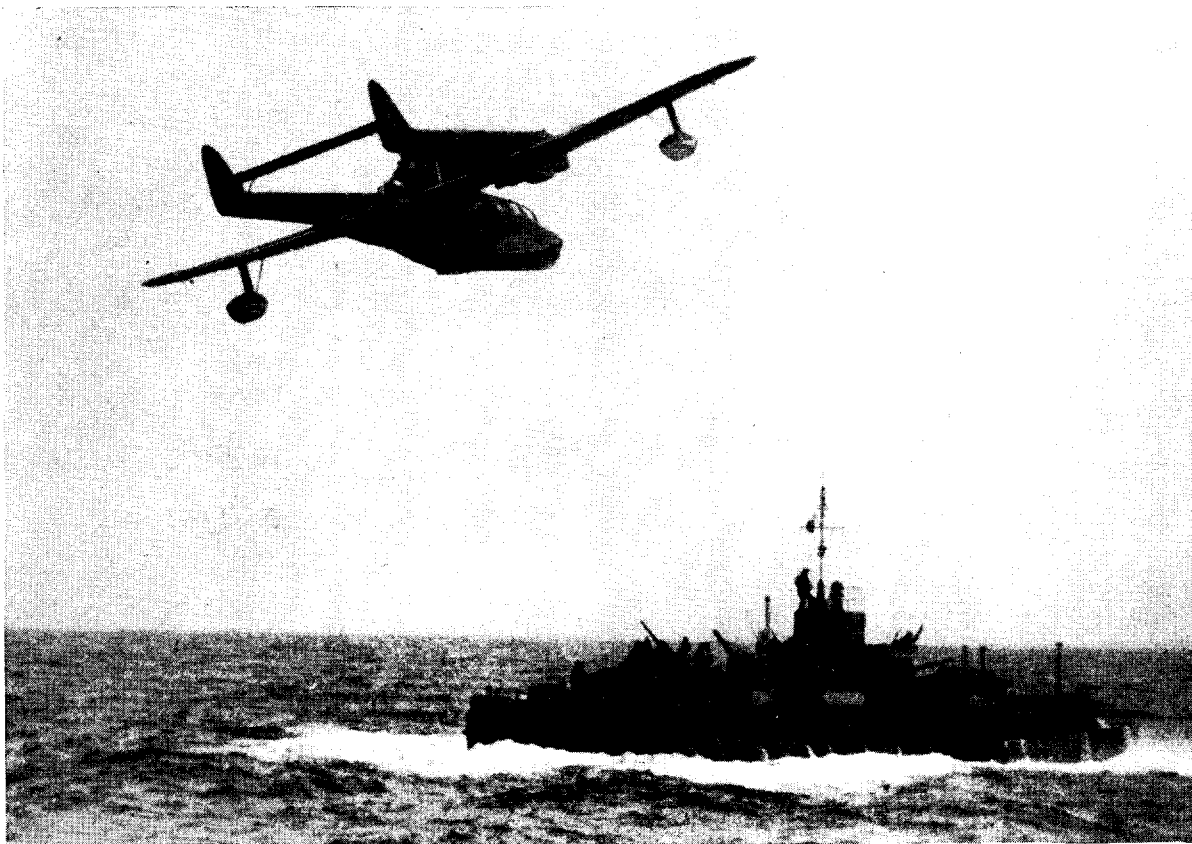


Figure 32.—BV 138 Three-Engine Flying Boat.

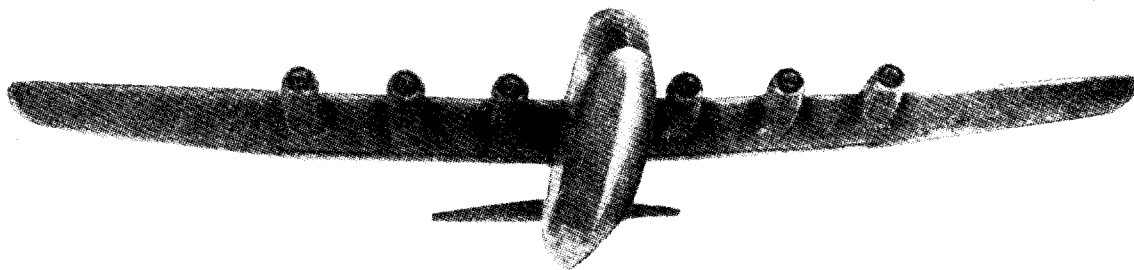


Figure 33. BV 222 Six-Engine Flying Boat

Figure 34.—HE 115 Twin-Engine Floatplane.



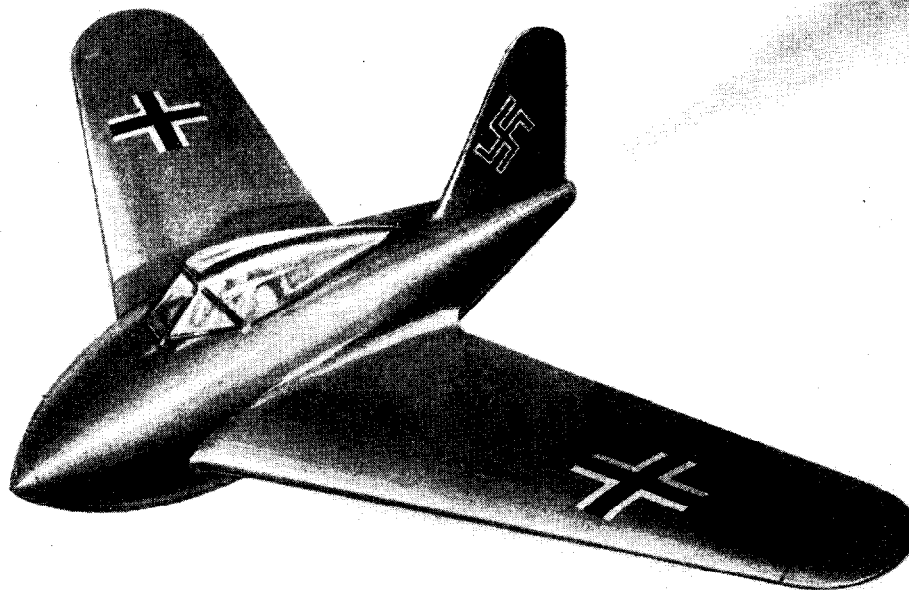


Figure 35.—ME 163 Liquid-Rocket Propelled Interceptor 1

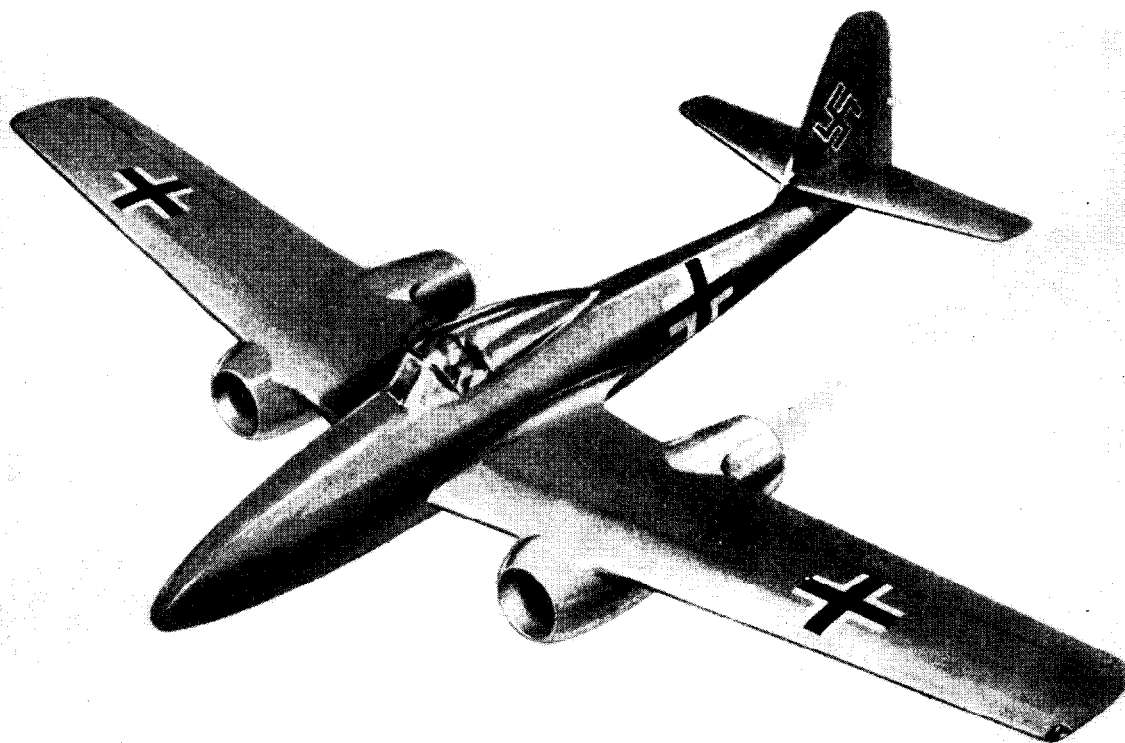


Figure 36.—ME 262 Jet-Propelled Turbine-Type Fighter

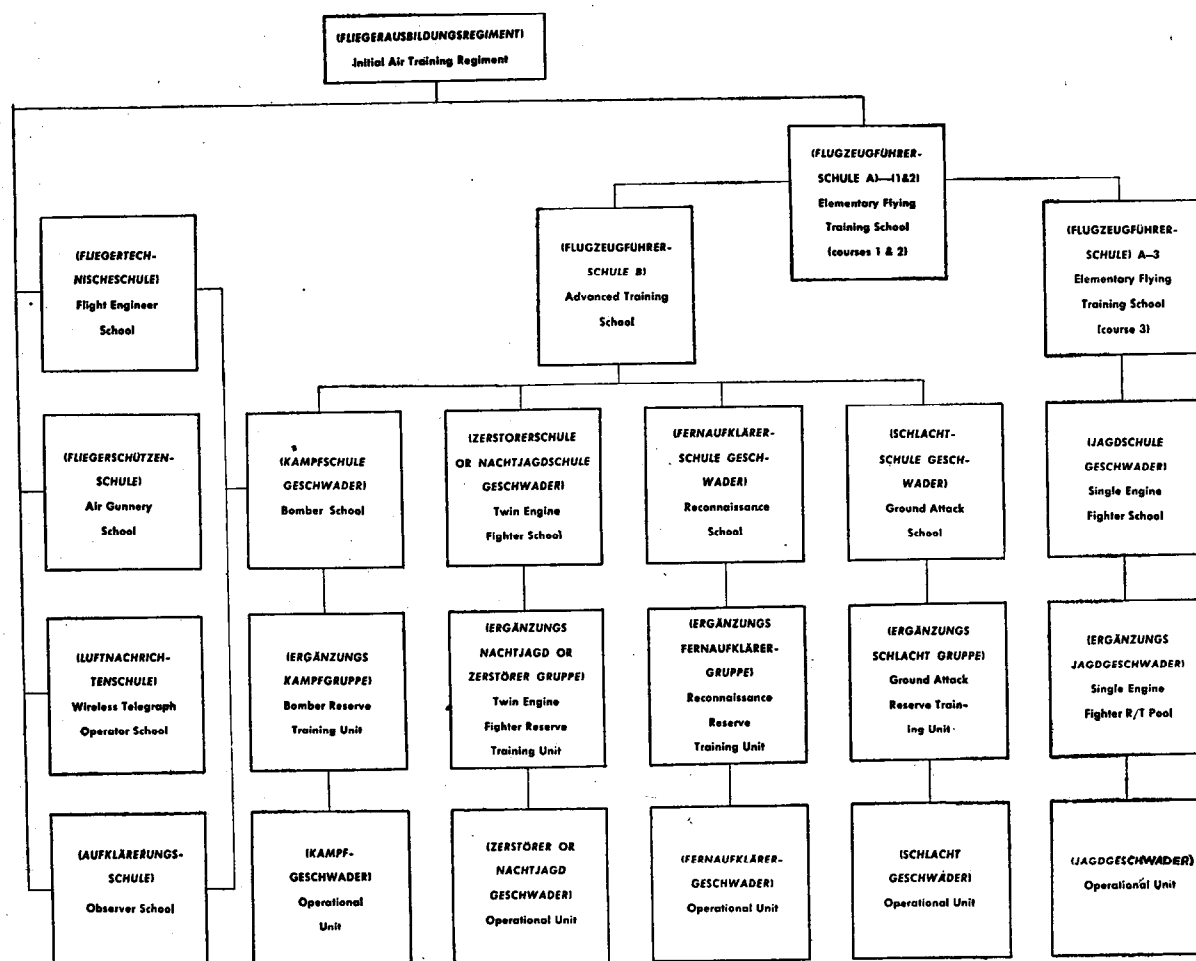


Figure 37.—German Air Force training program.

Section VI. TRAINING

1. General

Air Force training is the responsibility of the Air Ministry Training Inspectorate headed by the Air Officer for Training (*General der Fliegerausbildung*). Air Training Divisions control the assignment of recruits to training schools and assignment of trained pilots to operational units upon orders from the Air Ministry. At the individual flying schools all training is under the control of a Director of Instruction Courses (*Lehrgangsteiter*), who is also responsible for the maintenance of the training aircraft.

2. Recruit Training

All prospective Air Force personnel are sent to German Air Force Initial Training Regiments (*Fliegerausbildungsregimenten*), where for six weeks to three months they receive military or

basic infantry training. Upon completion of Initial Training, pilot candidates enter Elementary Flying Training Schools. Personnel to be trained for the air crew positions of flight engineer, gunner, wireless operator, or observer are enrolled in their respective individual schools.

3. Elementary Flying Training

Pilot candidates proceed to and begin their actual flight training in the Elementary Flying Training Schools (*Flugzeugführerschulen A*). All pupils take Course Number 1, a brief glider training course, and Course Number 2, (*Motor Auswahl*), a preliminary course in powered aircraft. Unsuitable trainees are eliminated, and those acceptable are assigned to bomber or fighter training upon determination of their qualifications. Students in single-engine, fighter-pilot training continue through Course Number 3 (*Jagdvor-schule*), a branch of the Elementary Flying Training School, for preliminary instruction in

fighter aircraft. This course includes aerobatics, cross-country, and formation flying.

4. Single-Engine Fighter Training

The single-engine fighter pilot progresses from Course Number 3 of Elementary Flying Training School to the specialized single-engine fighter school (*Jagdschule*) *Geschwader* where he learns to fly operational fighter types. He also receives instruction in gunnery, blind flying, and formation flying. He is next assigned to a Reserve Training Pool (*Ergänzungs Jagdgeschwader*) where he receives intensive combat training prior to joining an operational unit. The total time necessary to produce a single-engine fighter pilot is from 7 to 8 months, including flying time of from 107 to 112 hours.

5. Advanced Training or Conversion School

Upon completion of the Elementary Flying Training School (A) Course Number 2, the bomber, reconnaissance, ground-attack, and twin-engine fighter pilots are sent to an Advanced Training or Conversion School (*Flugzeugführerschule B*). Here they are instructed in the handling of multi-engine aircraft, in blind flying, link trainer, instrument flying, and the use of direction-finder apparatus. Two or three months are spent in this phase of training.

6. Specialized School *Geschwadern*

a. **BOMBER TRAINING.** From the Advanced Training or Conversion School the bomber pilot is sent to a Specialized Bomber School (*Kampfschule*) *Geschwader*, where pilots and members of their crews are assembled as units. This course includes formation flying and leading, torpedo and tactical bombing, high level and precision bombing, minelaying, and bomb ballistics. The total training period of a bomber pilot comprises about 9 months.

b. **TWIN-ENGINE FIGHTER TRAINING.** From the Advanced Training School, prospective twin-engine fighter pilots proceed to a Specialized Twin-Engine School *Geschwader*, either day (*Zerstörerschule*) or night (*Nachtjagdschule*). Here they are instructed in gunnery, blind flying, bad weather flying, mock attacks, and operational day and night flying. A twin-engine pilot spends from 6 to 7 months in training.

c. **GROUND-ATTACK TRAINING.** Upon completion of the Advanced Training School course, ground-attack students advance to a Specialized

Ground-Attack School (*Schlachtschule*) *Geschwader*. Here the instruction includes dive bombing, strafing, aerobatics, rocket firing, and navigation. The total time required to produce a ground-attack pilot is about 5 months.

d. **RECONNAISSANCE TRAINING.** Proceeding from the Advanced Training School to a Specialized Reconnaissance School (*Fernaufklärerschule*) *Geschwader*, students training for reconnaissance pilots are instructed in aerial photography, visual reconnaissance, and navigation.

7. Reserve Training Units

After completion of instruction in their individual specialized school, *Geschwadern*—bomber, twin-engine, ground-attack, and reconnaissance—together with their assigned crews, are advanced to their respective Reserve Training Units (*Ergänzungs Kampfgruppe*, *Ergänzungs Nachtjagd* or *Zerstörer Gruppe*, *Ergänzungs Fernaufklärer Gruppe*, *Ergänzungs Schlacht Gruppe*). Here they are assigned to a non-operational *Gruppe* of a *Geschwader* until such time as vacancies occur in the operational *Gruppen* of the unit to which they are attached. Thus, training periods in this phase vary according to operational requirements. In such *Geschwadern* the crews receive intensive training under combat conditions in the specific tactics of the unit.

8. Air Crew Training

From the Initial Training Regiment prospective air crew members proceed to their respective specialist schools: Observer's School (*Aufklärungsschule*); Wireless Telegraphy School (*Luftnachrichtenschule*); Air Gunnery School (*Fliegererschützenschule*); and Flight Engineer's School (*Fliegertechnischeschule*). Observer candidates spend 1 to 2 months learning map-making and reading, navigation, bombsights and bombing, meteorology, astro-navigation, and air gunnery. Students in wireless telegraphy undergo 1 to 2 months' intensive training in wireless transmitting and receiving, navigation, map reading, and radio direction-finding. Air gunners must complete a 1- to 2-months course, comprised of ground firing, camera-gun operation, air-to-air machine-gun firing, and elementary navigation. Students in flight engineering are given theoretical training in aircraft engines and aerodynamics. They also spend some time engaged in practical work on engines in an aircraft factory. Upon completion of their various courses, these specially trained

personnel are assembled with pilots into crews for unit training in a specialized school *Geschwader*.

Section VII. TACTICS

I. General

In more than 5 years of warfare new tactics had to be perfected to take advantage of improvements or new developments in both German and Allied aircraft and armament. Other factors have been the German Air Force's loss of its original numerical superiority and the new problems arising in the defense of the homeland due to continually receding front lines. As a result, profound changes have and are still taking place in German Air Force tactics. In general, however, it may be said that through the last few years the German Air Force has been increasingly on the defensive. It has been unable to go on the offensive, except occasionally and on a limited scope. Thus, the German Air Force tactics were modified from one of bold attack to one of conservation of strength, assuming risks only when decisive results appeared obtainable. Within the limitations of such enforced caution the German Air Force has held to its basic concepts of surprise, concentrated attack and exploitation of the enemy's mistakes.

2. Long-Range Bombers

a. OPERATIONS EARLY IN THE WAR. The German Air Force never has had a heavy bomber force. Its long-range bomber force has consisted of medium bombers designed originally for close, as well as indirect, support. Typical of its intended purpose were the large-scale bombing attacks on airfields which initiated the German campaigns against Poland, France, and the Lowlands. The inadequacy of this bomber force for strategic operations was revealed in the Battle of Britain. The deficiency was never corrected, and thereafter the main employment of the long-range bomber force was as close support, a function which progressively declined as the German Air Force lost more and more its previous air superiority to the growing fighter forces of the Allies.

Units specializing in anti-shipping activities have comprised the most experienced and efficient branch of the bomber force during the war. They too eventually proved inadequate to their main mission when major Allied landings were made on the coasts of Europe.

b. RECENT TREND. In view of these factors, the German Air Force in the summer of 1944 substantially curtailed its bomber force. The relatively few units remaining operational are today engaged in the following operations:

(1) Level bombing from medium height, in dusk or dawn attacks by small formations on bridges, railroads, dock facilities, and targets of opportunity in the rear of battle areas.

(2) Mining of coastal waters and estuaries at night.

(3) Occasional torpedo attacks on shipping.

(4) Miscellaneous minor activities such as air launching of pilotless aircraft, "pick-a-back" attacks on shipping, docks and bridges, etc.

3. Ground Attack

a. "STUKAS." Ground attack is the extremely close support of ground forces in the battle area illustrated by the close teamwork of aircraft with advancing *Panzer* columns which was the basic formula of Germany's *Blitzkrieg*. The "Stuka" dive-bombing JU 87 was the air artillery which on short summons from the ground forces cleared road blocks and reduced opposition. It also roamed behind the enemy's line disrupting traffic and creating confusion. For such tactics, complete mastery of the air was a requirement. In the early campaigns, the skies were swept clear of opposition by sudden attacks on enemy airfields followed by destruction in the air of such aircraft as had escaped. Without such freedom from enemy fighter interception, the "Stuka" was too vulnerable and could not operate. This became apparent in the later stages of the Tunisian campaign. With the advent of appreciable Allied fighter strength, dive bombing in daytime continued only in areas where the enemy lacked fighter strength such as the Partisan sectors of the Balkans or where special front characteristics, such as the vastness of the Eastern Front, made their employment still possible. In the West, dive-bombing "Stukas" have been relegated to individual night sorties chiefly against troop concentrations, headquarters and other front-line objectives.

b. TWIN-ENGINE FIGHTERS. The German Air Force unsuccessfully experimented with heavily armored twin-engine fighters to fill the place left vacant by the obsolescence of the "Stuka". The HS 129 never proved satisfactory and is disappearing from the Eastern Front, its only sphere of operations.

c. SINGLE - ENGINE FIGHTER - BOMBERS. (1) The German Air Force then turned to the single-engine fighter to meet the ground-attack needs. The FW 190 equipped as a fighter-bomber, proved satisfactory, and re-equipment of the *Schlacht* Units with this type apparently was intended.

(2) The fighter-bomber tactics are familiar. They consist of medium-height approach by small formations, ranging from a *Schwarm* of five planes to a half *Gruppe*, though occasionally concentration may be attempted. Troops, transport columns, and airfields are dive-bombed by each plane in turn, then strafed with the aircraft armament. Attacks against tanks or well defended sites are likely to be made from approaches at treetop level, and main reliance may be on cannon and machine-gun fire.

(3) Fighter-bombers, however, are still vulnerable to regular fighter attacks. It is therefore quite usual for them to be accompanied by a high cover of their own fighters, at least for the outward leg of their journey.

(4) The large numerical superiority of the Allied fighters on the Western Front after the Normandy landings prevented the German Air Force from giving adequate protection to its ground-attack aircraft and thus denied the possibility of any substantial close-support effort. On the Western Front today the fighter-bomber FW 190 is found in night harassing units, where it joins the JU 87 in attacks on headquarters, troop, communication and transportation systems. These night activities have been further augmented by assigning similar tasks to some of the twin-engine night fighters. These missions are generally individual free lance operations.

d. JET AIRCRAFT. Introduction of jet aircraft as ground-attack equipment is the latest German Air Force move in its endeavor to maintain close support by day for the German ground troops. Their tactics are based on the use of speed to escape antiaircraft defense fire or air interception. Jet aircraft attacks on airfields and troop concentrations have been made occasionally with anti-personnel bombs from great height in daytime. Most attacks, however, are at dusk, principally against bridges, dock facilities, railroads, etc, with small bombs. These attacks are made generally by single planes in dives from medium or low height. If attacking in pairs, one aircraft is likely to approach at medium height while the other follows at much lower level.

4. Fighter Tactics

a. MISSION. The mission of the fighter aircraft, be it day or night, single- or twin-engine, is the destruction of the enemy's air force and the protection of its bombers, ground-attack planes, etc., against enemy fighter action. As the development of the war forced Germany more and more on the defensive, the German Air Force fighters have been increasingly occupied with the interception of enemy bomber penetrations. Tactics have been continually revised to meet problems presented by new enemy equipment, greater fire power, new enemy defense formations, and increased enemy fighter cover. Only the most general principles can be outlined.

b. INTERCEPTION. (1) Against enemy day penetration, the German Air Force single-engine fighter tactic is to avoid if possible the fighter screen protecting the enemy bombers. Before the advent of Allied long-range fighters, the German fighters were wont to wait until the Allied bomber formations had reached a point beyond the range of their fighter cover. To insure such an unprotected period, the German Air Force sometimes made early attacks on enemy fighter cover to compel them to drop their auxiliary fuel tanks and thus shorten their protective flights. Always on the alert for opportunities, the German fighters would take quick advantage of gaps between successive fighter cover waves.

(2) Main tactics against the bomber formation have remained the concentrated attack against one particular group of the enemy bomber formation, preferably an outside or laggard one. Effort is made to bring the bombers to loosen their formation and thus lose much of their advantage of combined cross fire. Individual attacks are from the sun if possible, but the main consideration being the defensive fire power of the attacked bomber, approach will differ according to the type of aircraft faced. Single pass and mass attacks have both been employed.

(3) Twin-engine day fighters were used for a time, especially in rocket attacks, for the purpose of breaking enemy formations. The vulnerability of the twin-engine fighter to enemy fighters brought an end to these tactics as soon as the latter were able to accompany in force their bomber formation all the way to and from their target.

(4) Against other fighters, German Air Force single-engine fighter tactics follow whenever possible the usual basic principles of attack from the

sun, from above, and from behind. Speed and maneuverability remain as always the decisive factors. Tactics are based on the "Rotte" formation of 2 planes, number two flying wing man protection for his leader.

c. NIGHT FIGHTERS. Against enemy night penetration, the German Air Force night fighters have been equipped with both single- and twin-engine aircraft, but the latter has really been the basic equipment of the force. Two main night fighter-tactics have been the free lance, independent hunt, or the attack guided by radio from a ground control. In either case the attack is by single aircraft and target location is generally determined by airborne radar, though in some cases it is accomplished by visual sighting.

d. INTRUDER ATTACKS. Twin-engine fighters have carried out night intruder attacks. This consists of attacks against returning enemy bomber aircraft on or near their bases as they prepare to land as well as strafing attacks against the airfields.

5. Airborne Troops

a. ATTACK ON CRETE. In the early stages of the war Germany tried various methods of employing air-landing troops in the Lowlands, Norway, and the Balkans. Tactics for airborne combat became more clearly defined, however, in the combined attack on Crete, which was the first airborne invasion and capture of strongly defended territory across a body of water. The pattern established then consisted of the following:

(1) Short, intensive low and medium bombing and strafing of enemy positions in the intended landing area, immediately preceding or even simultaneous with the landing of glider-borne and parachute troops.

(2) As these troops proceeded, according to plan, to disrupt communications, silence local defenses, and seize airfields or other suitable landing grounds, areas surrounding their immediate objectives were subjected to continuous bombardment.

(3) With the arrival of the airborne infantry and engineer units closely followed by heavier elements, the parachute and other shock troops were reinforced and this combined force continued the task of attacking enemy communications from the rear, drawing off reserves, and clearing the area for the armored forces which were to follow.

b. OPERATIONS SINCE CRETE. (1) Since the capture of Crete, increasing transport commitments on all fronts and Allied air superiority have placed almost insurmountable difficulties in the way of such large scale ventures. The Germans have, however, dropped parachutists and landed glider troops in conjunction with land operations.

(2) In Russia, the Balkans, and the December 1944 counteroffensive in the Ardennes, units varying in strength from a platoon to a battalion have been landed behind enemy lines to disrupt communications, to seize such key points as railroads, roadheads, bridges, and power stations, and to engage in other sabotage activities. When such tactics are employed, the troops, whether they are parachuted from the JU 52 or landed by the DFS 230, usually hold their positions a limited time before being relieved by advancing ground forces or attempting to work their way back to their own lines.

6. Supply by Air

a. PURPOSES. As the complex of the war changes, sustained operations on several fronts forced the German Air Force to use defensively aircraft that had previously been envisioned as spearheading short, decisive victories. The supply situation has been so desperate on many occasions that the German Army has had to rely upon air transportation of personnel, supplies and equipment for its existence. This was evident in Russia, North Africa, and the Balkans first as an attempt to reinforce the *Wehrmacht*; when that failed, efforts were made to carry out evacuation by air. Although the JU 52 has been the mainstay in these operations, the German Air Force has employed nearly every type of its operational aircraft. Most recent application of the defensive mission of the German Air Force transports has been the supply of isolated garrisons in the Channel and Biscay ports and in other isolated localities. These landings or dropping of supplies are essentially emergency measures—carried on when all other means of supply are interrupted.

b. METHODS. A landing operation, accomplished by power-driven aircraft or by freight-carrying gliders, is the safest method of air supply if proper landing facilities are available. Glider landings may be made in good or bad weather after precise agreements on signals and markers have been reached. Power-driven aircraft have the additional asset of being able to

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carry off wounded and make other evacuations on the return trip. Supply-dropping operations have been necessary in other instances. These usually have been carried out by night, although some have taken place during the day. Whichever method is used, careful arrangements have to be

made as to the time and locality of the dropping, and for the cessation of local defenses. Night missions, moreover, necessitate increasing the size of the dropping zone and more careful marking of the approach and target area with flares and other signals.

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